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THE AVIATION WEEK

B-36 vs. Fighters—Analysis

Performance of the Convair B-36B intercontinental bomber has blurred the generally accepted picture of postwar military aviation.

Efforts of the latest U. S. Air Force jet fighters against the giant bomber above 40,000 ft. altitude indicate that the edge, surprisingly, lies with the piston engine bomber rather than with the flaming-tailed jets.

Gen. Hoyt Sanford Vandenberg, USAF Chief of Staff, states that his main concern now is not how to protect the B-36 against enemy fighters but how to develop USAF fighters capable of stopping a B-36 type assault on the United States. This is startling news, both to observers who have watched the jets swoosh to a maximum of 670 mph. around sea level and to taxpayers who have poured their dollars into an extensive and expensive jet fighter plane program.

Pendulum Swings

The present picture of the supremacy of the B-36 at altitudes over 40,000 ft. presented by the USAF, if it is accurate, does not mean that defense against this weapon is impossible and that the military balance has been tipped irrevocably in favor of the aerial offense.

Oldtimers in military aviation recall how the appearance of the Martin B-10 in the early 1930s overshadowed the fighter development of its vintage and threw the air strategists of that day into a similar mood as that now expressed by the proponents of the B-36.

Later, the first Boeing B-17 Flying Fortresses again outstripped their concurrent fighter crop.

Eventually the pendulum swung back in favor of the defense. U. S. bombers then found it necessary to have fighter escort in the face of German defensive measures. This constantly swinging pendulum between offensive and defensive weapons is one of the things that makes generals prematurely gray.

Tests in 1944

However the present unexpected ascendancy of the piston engine bomber at extreme altitudes should have come as no surprise to top USAF planners. As early as 1944 the then Army Air Forces conducted tests between stripped down Boeing B-29s and the first model Lockheed F-80 jet fighters at altitudes of from 30,000 to 35,000 ft. These tests indicated that the maneuverability of the jet fighters at that altitude was not sufficient to make an effective weapon against the stripped down B-29. As a result of these tests the decision was made to send the first atomic bomb-carrying B-29s over Japan unescorted at 30,000 ft.

Since those significant and historic tests the USAF has embarked on an extensive and expensive jet fighter program in which speed was the prime objective. While this fighter program was under development more tests were run pitting the new F-80s against more stripped down B-29s and B-50s and finally the entire USAF fighter stable against the B-36.

USAF now admits in effect that this fighter program aimed at speed has not produced a fighter capable of dealing with the B-36 at its top bombing altitudes. As evidence that USAF believes this to be a fact is the recent cancellation of the North American F-93A, a greatly improved F-86, cutback of the F-84 production program, and purchase of more B-36 bombers.

Revalue Fighters

USAF fighter development program is now in process of reevaluation with no clear direction of its future yet discernible.

Vast improvements in armament, powerplants and maneuverability are apparently required to cope with even the B-36 type of bomber above 40,000 ft. One school of thought leans toward the rocket-powered interceptor with a tremendous rate of climb and a motor that carries its own oxygen in the thinning atmosphere above 40,000 ft.

Another school believes that the concept of a single-seater fighter is outmoded and what is really needed is an "air destroyer" capable of meeting the bomber at its own altitude with airborne radar capable of long range detection and armament of air-to-air missiles to avoid the limitations of attacks made on a curve of pursuit.

One of the questions raised in the present B-36 vs fighter controversy is: Why has the Navy not been requested to pit the best of its current fighter crop against the Convair bomber? Some Navy fighter experts argue that the piston-powered Chance Vought F4U-5 could handle the B-36. Others think the Cutlass (F7U-1) with its twin jets and afterburners would do the trick. Certainly the top military planners of the National Military Establishment should find out.

Similarly it strikes some observers as absurd to run Navy maneuvers in the Caribbean with an atomic bomb being delivered by a P2V from 21,000 ft. rather than by the best atomic bombers of the USAF.

Total Air Power Concept

Concept of total U. S. air power as the real measure of our aerial capabilities is certainly not being furthered by this type of compartmentalized development and testing. In some fields such as turboprop development, spare parts purchasing, etc., this concept of total air resources has been applied but there seems to be an urgent need for its extension to more significant fields.

The present state of the USAF fighter program is a good example of where such compartmentalized philosophy can lead.

AVIATION CALENDAR

Mar. 22—ICAO African-Indian ocean air navigation meeting, Algiers.

Mar 22-24—Air Transport Assn., annual airline engineering and maintenance conference, Continental Hotel, Kansas City

Apr 11-15—Society of Automotive Engineers national aeronautic and air transport meeting, Hotel New Yorker, New York

Apr 11-16—Western Metal Congress and Exposition sponsored by American Society for Metals, Shrine Civic Auditorium, Los Angeles, Calif

Apr 19-20—Fifth annual meeting of the Magnesium Assn., Edgewater Beach Hotel, Chicago

Apr 18-21—AIEE southwest district meeting, Baker Hotel, Dallas, Tex

Apr 24-27—American Assn. of Airport Executives convention, Oklahoma City

Apr 29-30—Sixth IAS personal aircraft meeting, Hotel Allis, Wichita.

May 2-4—2nd annual meeting of the Airport Operators Council, Denver

May 5-6—Purdue University School of Aeronautics air transportation conference, Lafayette, Ind

May 10—IATA traffic conferences, Europe.

May 11—IATA technical conference, Switzerland.

May 16—National Fire Protection Assn. committee on aviation and airport fire protection, Fairmont Hotel, San Francisco

May 19-21—Society for Experimental Stress Analysis spring meeting, Hotel Statler, Detroit, Mich

May 23-24—Annual meeting of the Magnesium Assn., Edgewater Beach Hotel, Chicago

May 23-26—Eighth national conference, Society of Aeronautical Weight Engineers Inc., Biltmore Hotel, Dayton

May 24-27—Second joint conference of IAS Royal Aeronautical Society, Hotel Astor, New York City

May 26—IATA executive committee, Montreal

June 5-12—Sixth annual Michigan Aviation week

June 4-6—Fourth annual air fair and industrial exposition, Shawnee, Okla.

June 7—Third ICAO assembly, Montreal

June 20-24—AIEE summer general meeting, New Ocean House, Swampscott, Mass

June 26-27—NAA 37th annual national convention, Akron, Ohio.

Sept 1-7—International conference of Federation Aeronautique Internationale, Wade-Park Manor, Cleveland, Ohio

Sept 3-5—National Air Races, Cleveland.

Sept. 12—IATA fifth annual general meeting, The Hague

PICTURE CREDITS

12–North American, 14–U. S. Navy, 16–U. S. Air Force

NEWS DIGEST

DOMESTIC

Civil Aeronautics Board has approved application of Northeast Airlines for a $1,750,000 Reconstruction Finance Corp loan

Clark B Millikan has been named director of the Daniel Guggenheim Laboratory of Aeronautics and chairman of the Jet Propulsion Laboratory Board at the California Institute of Technology, where he is professor of aeronautics Dr Millikan has been acting in those capacities since 1944. He succeeds Dr Theodore von Karman, who continues as a professor of aeronautics at Cal Tech.

Pan American Airways reached agreement with Transport Workers Union on wages for 650 pursers, stewards and stewardesses Agreement sets pay increase of $12 a month for those earning from $175 to $340 plus $10 a month from Oct. 1, 1948 to Mar. 1, 1949.

Fairchild Engine & Airplane Corp last week announced closing of its Personal Plane division at Strother Field, Winfield Kan., and cessation of personal plane activities except supply of replacement parts to owners of Fairchild F 24 four place planes Announcement followed a definite decision to shelve the all-metal experimental low-wing Fairchild F-47 four placer.

FINANCIAL

Continental Motors Corp reports profit before taxes of $6,075,663 for fiscal year ended Oct 31, 1948, on sales of $108,157,527 Aircraft engine sales accounted for about $5 million compared to approximately $8 million in the preceding year

General Electric Co. reports profit of $217,717,916, before taxes of $93,700,000, on sales of $1,632,700,606 for the year ended Dec 31, 1948 Sales, a peacetime high, also exceeded the peak wartime year of 1944.

FOREIGN

British Ministry of Civil Aviation reports the government is proposing a complete merger of British South American Airways and British Overseas Airways Corp. BSSA's operations have been crippled by withdrawal of all Tudor IV aircraft and consolidation of the two government-owned carriers would permit the main services of both lines to be organized with a minimum number of planes.

International Airport will be constructed at Suva Point, Fiji, to serve the Australia-North America route Britain, Australia and New Zealand will each bear one-third the cost, as yet undetermined

INDUSTRY OBSERVER

▶ Watch for a new trend in fighter-type aircraft Both USAF and Navy thinking along this line has been changed by the relative performance at altitudes above 40,000 ft of the Convair B-36 and latest jet fighter types (AVIATION WEEK, Mar 14). One of the ideas being kicked around as the answer to the B-36 is a "destroyer" type plane that will be large enough to carry powerful airborne radar and launched air-to-air missiles against bombers Other trend will probably be toward rocket-propelled interceptors exploring the possibilities begun by the German ME-163 fighter and the Bell X-1 research plane

▶ **Top altitude reached so far by the B-36 has been 46,000 ft This was one of the B-36As, an earlier model with less powerful engines than the B-36B and B-36D. B-36 flights above 40,000 ft have also upset the old data used in all engineering calculations of a constant temperature above 35,000 ft. of minus 67 deg. F Temperatures ranging down to minus 110 deg F have been encountered on B-36 flights around 40,000 ft Under these conditions it is not surprising that some auxiliary equipment designed for the minus 67 deg. F minimum have failed Big surprise is that so much of this equipment still works even at minus 110 deg. F.**

▶ North American Aviation is about to conclude its agreement with Canadian Car and Foundry Co for Canadian manufacture of the Sabre (F-86A) at Cancargo's Montreal plant. Specific clause will exclude sale of F-86 spare parts by Cancargo to U. S. Air Force

▶ **A. V. Roe of Canada has built a new jet engine—the Avro Orenda—at its Toronto plant. New jet is rated at about 5000 lb. static thrust The Orenda may be used in both the Avro C-100, twin jet night fighter and the North American F-86A models manufactured in Canada**

▶ Boeing is accelerating production schedules on its B-50 bomber series Total of 12 B-50s were delivered during January with 14 scheduled for February By the end of 1948 Boeing was delivering the B-50 at a rate of 10 per month

▶ **McDonnell F2H-2, latest model Banshee jet fighter, features wing structural modifications to accommodate wing tip auxiliary fuel tanks Earlier Phantom mounted fuel tank under belly, which created ground clearance problem aboard carrier decks F2H-2 will mount auxiliary tanks at tips to avoid such clearance difficulty New model also features revised instrument arrangement and various other minor modifications**

▶ Northrop Aircraft investigation of the possible application of a commercial model turbodyne engine as a railway power unit apparently has cooled A Union Pacific diesel locomotive, parked at the Northrop plant during two years of turbodyne development, has been removed

▶ **FAMA has sent flight crews to San Diego to pick up the first of five Convair-Liners purchased under a $2.5 million contract with Convair Purchase of a sixth Convair-Liner is still being considered by FAMA**

▶ Air Force is studying test data on the 1000 lb razon and 12,000 lb tarzon radio-controlled bombs and the JB-2 pilotless aircraft subjected to Arctic tests last month at Ladd Air Force Base, Fairbanks, Alaska The two bombs were dropped from B-29 bombers and guided in their flight by radio control The tarzon flight is illuminated by flares mounted in the tail The JB-2, U S version of the German V-1 "buzz bomb", was launched both from the ground and from the wings of a B-29 bomber Purpose of the tests was to develop performance data and handling techniques for use in cold weather under actual Arctic conditions

▶ **McDonnell has delivered both the second XF-85 and second XF-88 to Muroc Air Force Base, Calif., to join their prototype aircraft in flight test status**

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Congress Cool to Prototype Proposals

Support lacking from manufacturers, who favor stressing military aircraft program.

Legislation authorizing the government to finance a program for development of new commercial transport and cargo planes will be kept on ice for this session of Congress

Pointing to this, are these factors

• **Congressional interest has dwindled** Senators on the Interstate and Foreign Commerce Committee are increasingly aware that airlines' inability to finance new plane purchases is but one result of their unhealthy economic condition Their main concern is to determine, and correct the causes of the condition This will be the aim of the committee's investigation into airline finances Temporarily stymied by the Senate filibuster, the investigation is expected to get underway in the near future

• **Aircraft manufacturers' opposition has solidified** The report of the informally organized inter-departmental committee, headed by Grant Mason assistant to the Secretary of Air, mapping out a concrete program for development of four new transport-cargo types (AVIATION WEEK, Dec 13) has turned manufacturers from cool to cold on the program In basic performance characteristics, the planes proposed for development are identical with existing types The manufacturing industry is now convinced that a substantial military aircraft program is the best method of promoting aeronautical research and development

Air Transport Assn will continue to push for legislation along the lines of the Brewster Hinshaw bill (which barely missed enactment last year) setting up an inter-departmental board to direct a commercial plane development program But ATA's main task will be to explain and justify current government assistance to airlines before it can win support for a new program involving millions of dollars in indirect government subsidization

▶ **Modification Possible**—It is likely that Senate Interstate Commerce Committee's investigation will result in a modified proposal aimed at assisting airlines in new plane purchases Cloakroom talk indicates that this might entail

(1) **Broadening the transport and cargo programs** of the Air Force and Navy,

(2) **Extending the maritime program,** under which the government finances a portion of the construction cost on ships (to offset the differential between labor and other costs between U S and foreign yards) to the aircraft industry

The three working subcommittees of the Mason's inter-departmental committee were headed by Harold Hockstra of the Civil Aeronautics Administration, George Burgess, of the CAA, and Paul Cherington of the Civil Aeronautics Board

Following are plane types recommended for development in the committee's report

• **Long-Range** 15-ton capacity with 2000-mile range, capable of operating from a 4000-ft field for short-haul service with a bigger cargo load and smaller fuel load Cost, in production (minimum of 300) $890,000, without reflecting development costs estimated at $32 million Operating cost ten cents per ton mile Speed 300 mph Basically, the craft would be comparable to the Boeing Stratocruiser, the Douglas DC 6, and the Lockheed Constellation aircraft

• **Short-Haul** Five-ton capacity with 1000 mile range Cost, in production (minimum of 150) $360,000, without reflecting development costs Operating cost 5 9 cents per ton mile Speed 300 mph Basically, the plane would be comparable to the Convair Liner and the Martin 2-0-2.

• **Feeder** Two and a half-ton capacity with 400-mile range, capable of operating from a 2000-ft field Cost, in production (minimum of 100) $120,000 without reflecting development costs estimated at $8 million Operating cost 9 3 cents per ton-mile Basically, this would be comparable to the Northrop Pioneer, the Beech Twin Quad and Chase Avitruc

• **Seaplane** 25-ton capacity with 3200 mile range, capable of operating from 6000-ft seadromes Speed 250 mph Comparable to the Martin Mars

The committee does not recommend development at this time of a proposed jet transport involving $58 million in development costs

B-45 GETS JATO LIFT ON TAKEOFF

Aerojet Engineering Corp liquid JATO units give 6000 lb of rocket thrust to this North American B-45's 20,000 lb of takeoff thrust provided by four General Electric J-47 (TG 190) turbojets Intense brilliance of exhaust flame is indication of use of liquid JATO rockets. Solid propellant JATO engines give less showing of flame, and heavier, dense white, smoke trail Mounting of JATO units under nacelles indicates that they will be released after firing and lowered by parachute

Wind Tunnel Bill

Legislation authorizing a $311 million transonic and supersonic wind tunnel construction program was introduced last week by Chairman Carl Vinson (D, Ga.) of the House Armed Services Committee

The program, a first-step implementation of the "unitary plan" worked out by the Army, Navy, Air Force, and National Advisory Committee for Aeronautics would include

• **Air engineering development center,** to be constructed by the USAF For "initial" construction, $150 million is authorized

• **$150 million expansion of NACA facilities** at Ames and Cleveland, including a 500 acre addition to the NACA installation located at the Langley Air Force Base Va

A $6,600,000 wind tunnel at the David W Taylor Model Basin Md, to be constructed by the Navy

• **Thirteen transonic and supersonic wind tunnels** at educational institutions, to be constructed by, or under the direction of NACA at a cost of $4,440,000

Europe Plans Secret Radar Net

Air attack defense screen will stretch 1500 miles; what to do after warning is Western Union's big problem.

By Boyd France

(*McGraw-Hill World News*)

PARIS—The five Western Union nations are budgeting to buy themselves half-an hour's warning of any future Russian air assault

First result of western European defense cooperation will be a vast, tight woven radar umbrella stretching 1500 miles from Lubeck on the Baltic Sea to southern Tunisia

Details are top secret Blueprinting the project are French, British Dutch, and Belgian air strategists, who are nearly ready to ask their respective parliaments for money needed to get the plan off paper Their proposed timetable

• **Appropriation** within the next three months

• **Construction** of the radar network to begin before year's end

• **Last radar beacon** to be in place within four years

▶ **Outline**—Here from key French strategists are the first broad outlines of the proposed network The radar blanket will cover Holland, Belgium Luxembourg, France, the British Isles, Corsica Tunisia, and at least the coastal belt of Algeria French and British zones of Germany will also be included Italy Denmark Norway and the American zone of Germany haven't been integrated in present plans, but may come in eventually within the framework of the Atlantic Pact

Each nation will finance construction and operation of radar posts on territory under its control at least during the initial period of construction, according to the present plans of the Western European air strategists

▶ **Equipment**—Most of the equipment for the Western Union radar screen will be supplied by France and Britain The French radar industry is looking forward to reaping a big crop of orders from the project France's Thomson Houston Co., the only concern in Europe known to be manufacturing CCA equipment, has developed a wide range of radar equipment, including precision beam Ground Control Approach type radar, surveillance radar, height finding radar, radar beacons, and other airborne equipment

The latest French radar would give Western Europe a security zone against surprise air attacks about 200 miles deep —the depth called for in Western Union radar plans French air strategists think it would be equivalent to about half-an-hour's warning of attack given the present average speed of current Russian bombers

This would be enough to alert Western European air defenses—provided adequate defensive weapons existed Right now Western Europe is much surer of getting a fool proof radar warning system than it is of getting the fighters and the anti-aircraft batteries which will be needed to take advantage of the warning

New B-36 Record

Bad weather forced abandonment last week of an attempted 10,000 mi nonstop flight by a Convair B-36B with a full combat load

The six-engine bomber of the Strategic Air Command's 7th Bomb Group flew 9600 air miles in 43 hr 45 min and dropped 10,000 lb of bombs in the Gulf of Mexico off Key West The bomb load was carried for 24 hr 55 min

Route of the bomber was north from Ft Worth to Minneapolis west to Great Falls, Mont south to Key West, Fla return to Great Falls, west to Spokane, Wash, and then back to Ft Worth On the final leg one engine was feathered due to an oil leak about six hours out of Ft Worth Strong head winds were also encountered on this leg over the Rockies

Approaching Ft Worth the B-36 still had 2 hr fuel in addition to its 5 percent emergency reserve It was ordered to land rather than continue on to the 10 000 mi mark due to weather closing in at Carswell AFB Ft Worth and its alternate field The 2 hr additional fuel would have put the B-36 up to the 10,000 mile mark Previous record for a B-36 with 10 000 lb bomb load was an 8400 mi roundtrip from Ft Worth to Honolulu Nonstop record without refueling is 11,236 mi held by a Lockheed P2V Neptune flown by a Navy crew from Perth, Australia to Columbus Ohio The P2V did not carry a bomb load

IAS Devotes Day To Jet Discussion

Fundamental change that the gas turbine has made in aircraft power plant work and study was reflected last week when the National Flight Propulsion Meeting of the Institute of the Aeronautical Sciences for the first time devoted all of its sessions to problems of jet engines

In three preceding annual meetings, also held in Cleveland, piston engines got a major share of attention This year, the one-day conference was to hear eleven papers, divided into three broad categories

► **Compressors and Turbines**—"Multi-Staged Centrifugal Compressors for Operation at High Pressure Ratios," John E. Talbert and John E Sanders, Wright Aeronautical Corp, "High Pressure Ratio Axial-Flow Compressors," R S Hall, General Electric Co, "High Pressure Applications of the Supersonic Compressor," John W Blanton, Frederic Flader, Inc., "High Pressure Ratio Gas Turbines," C Richard Soderberg Massachusetts Institute of Technology

► **Combustion**—"Some Aspects of Turbojet Combustion," A J Nerad, GE, "Problems on the Development of Turbojet Combustors," Stewart Way, Westinghouse Electric Corp, "Combustion Problems in Ramjet Design," F P Longwell Standard Oil Development Co, "Basic Studies on Flame Stabilization" Glenn C Williams MIT

► **Thrust Augmentation and Controls**—"Analysis of Turbojet Thrust Augmentation Cycles," Bruce Lundin, Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics, "Automatic-Control Considerations for Turbojet Engines with Tail Pipe Burning," Melvin S Feder and Richard Hood, Lewis Lab, "Comparison of Various Methods of Thrust Augmentation" Eldon W Hall, Lewis Lab

John Stack, assistant chief of research, Langley Aeronautical Laboratory, NACA, delivered the luncheon talk on "Aeronautical Research and the Future."

Vampires In France

License to manufacture the de Havilland Vampire jet fighter in France has been granted to Societe Nationale De Constructions Aeronautiques du Sud Est by de Havilland Aircraft Co., London Agreement was described as another step in standardization of military equipment in Western Europe Netherlands Sweden and Switzerland already have Vampire fighters purchased from de Havilland Negotiations for manufacture of the British Nene jet engine in France are also reported in progress

Dan Kimball receives oath of office from Rear Admiral George L. Russell, Navy Judge Advocate General, with Secretary John L. Sullivan as witness

Meet Dan Kimball

Navy Air Boss Once Army Pilot

But he still sees future for aircraft carriers, and thinks interservice competition produces progress.

By Robert Hotz

Naval Aviation took on a new civilian pilot last week when he intends to be "checked out" in the latest Navy jet planes

Fifty three-year-old Dan Kimball, unlike his predecessor, yachtsman John Nicholas Brown in the post of Asst Secretary of the Navy for Air, is no stranger either to a pilot's cockpit or the latest in aircraft propulsion methods

► **Doolittle's Classmate**—Kimball and another aviation cadet named James Harold Doolittle joined the Aviation section of the Signal Corps in 1917 They learned Morse code and what makes a piston engine tick in the same class at ground school in Berkeley, Calif They went on together through flight school at Rockwell Field, San Diego

Graduating from Curtiss Jenny (JN-4) trainers, Kimball flew a succession of the "hot" pursuit planes (130 mph) of the 1918 19 vintage—the British SE 5, Thomas-Morse Scout, later made by Boeing, and the Packard-Lepere Kimball remembers the Packard-Lepere as perhaps the best acrobatic plane he ever flew

► **Loop Record**—While doing a stint as an engineering test pilot Kimball and a friend thought about trying for a consecutive loop record in the Packard-Lepere Kimball decided the venture would take too long but the friend went on to do 620 consecutive loops, a record which still stands Next time Kimball saw him, years later, the record holder was flying more sedately for United Air Lines

Kimball stopped flying shortly after he left the Army as a first lieutenant in 1919 and went into the tire business on the Pacific Coast with the sales department of General Tire & Rubber Co of Akron, Ohio World War II rationing put an abrupt halt to the need for selling tires so Kimball, then a vice president, was asked to take over the rapidly expanding government activities of General Tire The firm was then making life rafts for the Army Air Force and Navy and soon became involved in taking on a number of unorthodox jobs for the services, including development of rockets and various types of jet propulsion

► **Fly Navion**—Kimball decided that since he was back in aviation he had better get his feet back on some rudder pedals In 1942 he took a 30 minute dual check ride in a Cub and began flying solo again

"Flying is like riding a bicycle," he says "You never really forget how to do it"

During the next five years Kimball rolled up considerable time in a North American SNJ, a Beech JRB and a Navion He found the Navion with an extra gas tank extremely useful in commuting between the various rocket test centers in Southern California at Muroc, Pt Mugu, and Inyokern, and his lumber interests in Northern California Now Kimball plans to graduate to jet jobs The very least he will settle for is some dual time in the back seat of a Lockheed TF 80C which the Navy has on order

► **Rocket Interests**—Since his wartime switch from tires to rockets Kimball has had more than an academic interest in the new propulsion methods that have wrought a technical revolution in aircraft design and performance At the end of the war General Tire decided there was a future in unorthodox propulsion methods and picked Kimball to supervise their interests in this field These interests included Aerojet Engineering Corp, developers of JATO equipment, Marquardt Aircraft Corp, specialists in ramjet and pulsejet engines and builders of an experimental ramjet helicopter; and Parson Aerojet Engineering Corp

Kimball says the technical experts at Aerojet, headed by Dr Fritz Swicky tell him that the field of propulsion still has much unexplored territory with perhaps a dozen new methods still untouched One of the jobs now under way at Aerojet is laying out power requirements for various equipment and then trying to find new propulsion methods to meet those requirements

► **Explore Altitude**—General Tire propulsion subsidiaries decided early in the game to stick to powerplants and leave the construction of missile shells, etc, to the airframe manufacturers Aerojet has worked closely with Douglas Aircraft Co and other manufacturers in developing high altitude research rockets to gather data from 100 miles on up

"There is a real need for data in this area into which we are rapidly moving," Kimball believes "We now need facts to prove or disprove the assumptions scientists have made regarding this unexplored region"

► **For Competition**—How will a former Air Corps lieutenant fit into seagoing aviation? Very well, Kimball believes He and his firms have been dealing with Air Force, Navy and Army and have some understanding of all their problems He has a lot of friends in all three services and that he thinks, will help a lot when wrestling with the problems of unification

Does he agree with his former classmate, Doolittle, who once testified that one of the chief characteristics of a Navy aircraft carrier was that it could be sunk? Decidedly not, says Kimball

"Jim and I have been arguing over that for 10 years and he hasn't convinced me yet These technical arguments between the services are not as unhealthy as some people think It's the way you keep competition alive and without competition you don't get much progress"

Cutlass Lost

A Chance Vought XF7U 1 Cutlass Navy twin-jet fighter was lost in a recent test flight from Naval Air Test Center Patuxent, Md It was the No. 3 prototype airplane and was flown by William H B Millar, former Navy pilot and Chance Vought Aircraft chief test pilot

The swept-wing craft was on a routine test flight, a part of which included "posing" for aerial photographs by a North American SNJ trainer plane equipped with a camera in the rear seat While taking pictures of the speedy new fighter, the SNJ crew watched it zoom into cloud at 7000 ft and it was not seen again A faint radio message from the XF7U was heard shortly thereafter but no further word had been heard up to midweek last week. Twenty-one Naval airplanes joined in the search over the Maryland-Virginia areas involved

Stock Shifts Shown In SEC Report

Major shifts in aviation share holdings by officers were revealed in a current report released by the Securities and Exchange Commission

Purchase of 2000 shares of American Airlines stock by Amon Carter of Fort Worth was among the transactions between mid-January and mid-February The purchase brought Carter's total holdings to 66,800 shares A holding of 30,000 shares by the Carter Foundation was also reported

C R Smith, AA president, years ago was granted an option to purchase 250,000 shares of American Airlines common stock at $11.70 per share up to June 1, 1950 From time to time, Smith evidently has been transferring a number of his options to other officers of American Airlines The latest such switch was made in March, 1948, but was revealed publicly for the first time in the current SEC report

The March, 1948, transfer represented total options on 59,500 shares, reducing Smith's remaining options to 167,500 shares Most recent transfers to individuals accounted for options on 27,500 shares which may indicate that the remaining options on 32,000 shares could have been switched for the benefit of others besides officers of American Airlines

► **Damon Options**—Ralph S Damon, former president, received options on 6000 shares of American in March, 1948 Subsequently, he sold a total of 4000 shares of American common (separate from options) in January, retaining 1000 at the end of that month Upon becoming TWA president, he purchased 1000 shares of that company's common stock, also in January

Other transactions

- After disposing of 500 shares through a gift T E Braniff had 239,324 shares of Braniff Airways Inc. at yearend
- I C H Bryant purchased 4600 shares of Capital Airlines stock in December boosting his holdings to 15,500 shares He also held $20,000 of the company's debentures.
- After receiving compensation stock amounting to 320 shares in December, J S. Woodbridge an officer of Pan American Airways sold a total of 500 shares in January, leaving a balance of 1164
- W G Price bought 500 shares of Cessna in December bringing his holding to 520 shares.
- E C Towl sold 400 shares of Grumman in the same month reducing his holdings to 5400 shares

ERCOUPE ROADABLE CONVERSION

Steerable nosewheel and detachable wings of the Ercoupe lend themselves to a road able vehicle in Warner Holland's experimental conversion of the plane Note screw for propeller Wings can be stowed overhead or attached for flight by two people in 30 min., according to Holland, who operates South Georgia Flying Service.

Cargo Package for Truck and Plane

Manufacturers studying proposal for aluminum unit to be used in both ground and air operations.

Cargo plane manufacturers are studying a new proposal to speed up cargo handling, with an indication that the plan eventually may get strong support.

The proposal involves development of an aluminum shell cargo package designed specifically to fit inside both a plane fuselage and a truck trailer In addition to the probability that it would improve efficiency and reduce the cost of air freight operations, the device is attracting interest because of the experience of its originator George Bryant Woods

George B Woods

Woods, now a civilian special assistant in USAF headquarters, was a specialist in aviation finance an Air Force combat intelligence officer in England and the Mediterranean a procurement officer at Wright Field, and an aviation consultant to White, Weld & Co, New York investment firm Because of his broad background, Woods is in a position to give his ideas wide circulation

He believes that air freighters can learn considerable from the operational techniques of the truck-trailer combination His cargo package would be used as the basic unit in both ground and air freight, permitting speedier loading and unloading operations and faster ground delivery The bulk of all handling delays would be transferred to the packages instead of keeping planes idle by slow and costly hand and lift loading methods now used

Since interiors of truck trailers are now pretty well standardized Woods suggests that their dimension would determine the size of the cargo package This would mean a container about 7 ft high, 7 ft wide and 22 ft long

▶ **Shipping Methods**—Large shipments could be loaded in the package at point of origin trucked to the nearest airport, loaded aboard a cargo plane as a unit preferably by means of rollers on the cargo plane floor flown to their air terminal and delivered to destination after another quick plane-truck transfer Smaller shipments could be accumulated at air freight terminals until a package is filled for a particular destination whereupon it is loaded on the first cargo plane headed that way

By having the pre-packaged cargo ready for fast loading and unloading the ground time of cargo planes could be reduced by two-thirds of present standards and air freighters would get considerable more utilization out of their planes than is now possible

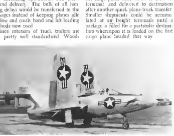
▶ **Three Types**—Woods envisions three types of air freighters using the cargo container A short haul air freighter would be roughly similar to the Fairchild C-82 with capacity for a single container A trunkline freighter would be similar to the proposed Curtiss-Wright CW-32 with capacity for two containers The transcontinental or international carrier would be along lines of the Douglas C 124A and carry three or more containers

All of these types should be designed for fore and aft loading and unloading, with cargo doors at the same heights as truck trailer floors to facilitate swift handling of the containers

Woods believes that an aluminum cargo package would cut a cargo plane's payload much less than the assortment of wooden and metal crates and braces now used He believes it would also be much less expensive than the detachable fuselage or "pod type" now being developed for military cargo use

Use of the container for air cargo would in no way detract from any other use that might be contemplated for the cargo plane as an emergency personnel carrier hospital ship or for handling special items of bulky cargo such as disassembled helicopter, fighter planes, etc

In commercial operations Woods estimates that a single cargo plane could keep up to three cargo containers operational Like many others who have studied the problem Woods is convinced that the commercial air cargo potential has only been scratched, that present air freight techniques are basically uneconomical, and that a large and prosperous air cargo fleet is one of the vital props for an effective military Air Force and a top priority item in any realistic organization of national defense plans



GRUMMAN PANTHER FOLDS WINGS

Grumman was forced to abandon its tricky wing-folding system (used on wartime F6F Hellcats and TBF Avengers) on its new F9F jet fighter due to low ground clearance of the new craft After extensive design studies, Grumman and Navy finally came up with this arrangement of simply folding them straight up Short outer panels still hold airplane height to less than 30 ft minimum required for carrier hangar-deck stowage First deliveries of production Panther fighters are now being made on orders totaling 317

Yearbooks Available

Single copies of Aviation Week's 1949 Yearbook, the second Inventory of U S Air Power, have been ordered by many companies and agencies desiring them for reference In anticipation of these requests, Aviation Week expanded, for the Feb 28 issue, its usual print order While the supply lasts extra copies are available at $1 each from Aviation Week McGraw Hill Publishing Co., 330 West 42nd St, New York 18, N Y

Bendix Radio Turns to New Line

Produces variety of air and ground equipment for use in connection with RTCA federal airways program.

Radio division of Bendix Aviation Corp is developing a new line of aeronautical equipment designed to meet the needs of aircraft that will be using the new federal airways system

The so-called interim system as recommended by the Radio Technical Commission for Aeronautics is based primarily on the omni range, distance measuring equipment and very high frequency radio

Equipment now in production at the Towson, Md, Bendix plant includes

• **Goniometers**—The basic component of the omni-range ground station Bendix has manufactured all of the goniometers used in the installation of some 400 omni-range stations in the United States and its possessions by the Civil Aeronautics Administration

• **Omni-range receivers**—The Bendix NA-3 omni receiver is a commercial adaptation of the equipment made for both Air Force and Navy This receiver provides reception facilities for the ground equipment omni range navigation, both old style and new phase comparison ILS localizers; two-course visual ranges, tower communications, company communications and part of the military communication band (132 135.9 mc)

▪ **Automatic VHF-direction finders**—The automatic VHF-DF equipment is recommended under the RTCA program for use with traffic control search radar for positive identification of aircraft in the approach control area The VHF DF ground equipment gives an automatic bearing on any aircraft transmitting on VHF

• **Distance measuring equipment**—Bendix plans to develop production models of airborne distance measuring equipment as soon as standardized specifications are approved by the various governmental agencies concerned with the airways system

• **Automatic course computer**—Pioneer division of Bendix Aviation Corp has developed an automatic offset course computer for use with its autopilot and the omni range and DME ground stations Pioneer will continue with development and production of this equipment since it also manufactures the Bendix autopilot

▪ **Ground controlled approach**—Bendix is continuing its development program on GCA including a production order for 12 mobile units for the Navy Bendix is also competing for civilian models of GCA to be procured by the Civil Aeronautics Administration

In addition to this special equipment Bendix is continuing production of its fan marker receivers which are now standard equipment on all airlines, glide path receiver antenna, radio compasses, microphones, jack boxes, and VHF communications equipment (both ground and airborne equipment)

In manufacturing its VHF equipment Bendix Radio has gone in heavily for subassemblies Aim is to achieve compactness of equipment without sacrificing ease of maintenance In most of the Bendix VHF equipment spare subassemblies can be used to keep equipment operational while maintenance works on the inoperational subassemblies

In addition to the equipment developed for use under the RTCA program, Bendix Radio is continuing its Flightweight line of personal plane radio equipment and expects to develop a lightweight VHF omni range receiver after sufficient operational experience has been accumulated on its larger military and airline type equipment The Towson plant is also making automobile radios, television receivers and standard broadcast receivers

The Radio division now employs about 2500 persons compared with 10,000 during its wartime peak

Small Business

Sixty nine percent of all Navy contracts (31 percent of all dollar value) let between May 19, 1948 and Jan 31, 1949, went to small business firms employing less than 500 persons each, W John Kenney, Navy Undersecretary, has announced

Small business was awarded 246,067 contracts with $317,358 073 value, out of a total of 358,732 contracts valued at $1,016,735 484

The Secretary commented that Navy procurement practice was to "step ladder" quantities in a procurement schedule when practicable, so that small concerns are able to bid on quantities that they can handle A widespread geographical distribution of procurement schedules is made in order to draw bids from as large a number of qualified firms as practicable

He invited small producers to keep in touch with prime contractors for whom they produced during the war for new Navy subcontracts, and pointed out that a large percentage of Navy field purchases are made with small firms

WHO'S WHERE

Bendix Aviation Corp, Detroit, Mich, elected George E Stoll and Lawrence A. Hyland vice presidents Both men have been with the company for a number of years Stoll, general

Hyland

Stoll

manager of the Bendix Products division—the company's largest unit—started out with Bendix in 1929 as a department foreman Hyland has been executive engineer and now will be in charge of aviation research He has been associated with Bendix since 1937

Sperry Corp, New York City, elected Thomas A Morgan president to succeed Thomas B Doe who resigned Morgan continues as chairman of the board Doe remains a director and a consultant to the corporation Harry F Vickers, a vice president, was elected senior vice president

Lear, Inc, Grand Rapids, Mich, elected D W Haven treasurer He continues as comptroller, a position he has occupied since last year Previously he was assistant treasurer of Solar Aircraft Co

Champion Spark Plug Co, Toledo, Ohio, elected Robert A Stranahan and James F Lewis, vice presidents Stranahan has been in charge of equipment sales and Lewis has been director of purchases

Monsanto Chemical Co named Richard T Clark branch manager of the New York sales office of the Merrimac division He succeeds W E Drown who goes to the Boston office as assistant to vice president Paul O Huntington of the New England Alcohol Co, partly owned subsidiary

Invitations and Awards to Industry by USAF

Air Materiel Command Procurement Division makes available to AVIATION WEEK the latest bid invitations and awards, shown on this page. Requests for further information should be addressed to Contracting Officer, AMC, Wright-Patterson AFB, Dayton, Ohio, attention MCPPSX72

Abstracts of Bid Awards

For 1600 gal of methyl ethyl (IFB 49-675)
Ameco Products Co Cincinnati O on a bid of $1469.16

For 1,000,000 lb cleaning compound (IFB 49-581)
Wyandotte Chemicals Corp. Wyandotte Mich on a bid of $14,552.43

For 54,126 buttons (IFB 49-583)
United Carr Fastener Corp., Cambridge Mass. on a bid of $6734.73

For 302 Technical Data Indicators (IFB 49-589)
General Electric Co Schenectady N Y on a bid of $10,408.80

For 208 screen assemblies (IFB 49-593)
Radiant Mfg. Corp. Chicago Ill. on a bid of $3070

For 700 heater kit assemblies (IFB 49-609)
Specialty Assembling & Packing Co Brooklyn N Y on a bid of $8160

For 180,000 ft sealing tape (IFB 49-617)
Armstrong Cork Co Lancaster Pa., on a bid of $16,522.50

For 47,165 bushings (IFB 49-625)
Companies sharing — Weatherhead Co., Cleveland O on a bid of $3504.46 and Imperial Brass Mfg Co Chicago Ill on a bid of $411.75.

For 7581 lb wire (IFB 49 635)
Hoskins Mfg Co Detroit, Mich. on a bid of $16,115.71

For 311,000 ft of hose (IFB 49 642)
Quaker Rubber Corp Philadelphia Pa. on a bid of $33,233.50

For 44,616 ft of tinned copper braid (IFB 49 487)
General Motors Corp. Warren O on a bid of $4269.86

For 85 conversion kits (IFB 49-480)
Crouse Hinds Co Syracuse, N Y, on a bid of $18,620.80

For 10,000 nozzles (IFB 49 490)
Aro Equipment Co. Bryan O., on a bid of $3160

For 8420 light assemblies (IFB 49 669)
Marco Industries Co. Anaheim Calif on a bid of $10,685.10

For chemicals (IFB 49-753)
Companies sharing—Conray Products Co New York N Y on a bid of $55,280; Fulton Gold Refiners Corp New York N Y on a bid of $872.25 and American Smelting & Refining Co New York N Y on a bid of $4701.66

For 20,991,000 sq in plastic sheet (IFB 49-599)
Monsanto Chemical Co Springfield Mass., on a bid of $51,449.52

For 91,656 lb of acid (IFB 49 613)
Companies sharing—City Chemical Corp New York, N Y, on a bid of $5517.20 Mallinckrodt Chemical Works St. Louis Mo on a bid of $2163.10 Fine Organics Inc New York N Y, on a bid of $211.26 and Oxygen Process Inc. Brooklyn N Y on a bid of $400.37

For 204 antenna groups (IFB 49 622)
Aeromotive Equipment Corp. Kansas City Mo on a bid of $10,568.55

For 22,700 lb of rivets (IFB 49-638)
Companies sharing—Reed & Prince Mfg Co. Worcester Mass on a bid of $23,360.46 and Air Associates, Inc., Teterboro N J, on a bid of $10,345.76

For 16 canopies (IFB 49 686)
Irving Air Chute Co, Inc. Buffalo N Y on a bid of $1788

For 38,000 packing list protectors (IFB 49-685)
Rogers Corp Goodyear Conn on a bid of $1111.68

For 80,327 gal camouflage enamel (IFB 48 666)
Companies sharing — Sherwin-Williams Co Cleveland O on a bid of $14,681.00; Cook Paint & Varnish Co North Kansas City Mo on a bid of $10,061.26 and Glidden Co Cleveland O on a bid of $8427.11

For 600 rolls of film (IFB 48 646)
Eastman Kodak Co Rochester N Y on a bid of $31,636.60

For photographic paper (IFB 49 672)
Companies sharing — Gevaert Co of America, Williamstown, Mass on a bid of $4606.90 Ansco Chemical & Film Corp. Newton N J on a bid of $7296 and Grant Photo Products Inc Lakewood O, on a bid of $7726.50

For 20 container assemblies (IFB 49-660)
Drexler Mfg Co, Inc New York N Y on a bid of $3656

Invitations to Bid

Bid openings are 20 to 30 days after approximate issue dates shown in the following bid proposals. Bid sets containing specifications for items to be procured will be sent to qualified applicants who state bid invitation number.

One bid set will be available for examination without obligation by prospective bidders after bid publication date at each of the seven AMC procurement field offices. This will enable firms to see specifications before writing or telegraphing for their own bid sets.

Procurement field office locations Boston Army Base Boston 10 Mass; Government Aircraft Plant No 4 Ft Worth 1 Tex; 70 S LaSalle St. Chicago 3; Wright-Patterson AFB Dayton, Ohio; West Warren and Longo Aves., Detroit 32; 1206 Santee St Los Angeles 54; 67 Broad St., N Y 4.

Current bid proposals

Resistor, 465 each bid invitation No 49-1390 Invitation issue date Mar 7 delivery—best possible.

Cylinder Thinner 358,025 gal bid invitation 49-1394 issue date Mar 7 delivery by Sept 30

Portable Analyzer 20 each bid invitation 49 1397 issue date Mar 8 delivery by June 11

Door 1 11 items bid invitation 49-1399 issue date Mar 7 delivery 60 days

Inverter 1093 each bid invitation 49 1400 issue date 49-1160 delivery 100 monthly

Photographic Equipment 1-21 items bid invitation No 49 1404, issue date Mar 7 delivery by July 1

Seal Assembly 2,560 each, bid invitation No 49 1406 issue date Mar 8 delivery 20 percent monthly

Capacitor 1958 each bid invitation No 49-1416, issue date Mar 7 delivery—best possible

Valve, 44,630 each bid invitation No. 49-1408 issue date Mar 6 delivery 60 days

Mounting 1677 each bid invitation No 49 1411 issue date Mar 6 delivery 100 days after approval.

Propeller Shoe 25,000 each bid invitation No 49 1417 issue date Mar 6 delivery 60 days

Self Locking Nut, 1 6 items bid invitation No 49-1418 issue date Mar 6 delivery by Mar 31 1950

Lock Assembly 1-9 items bid invitation No 49-1424 issue date Mar 10 delivery 20 percent monthly

Fuel Tank Sealant, 10,000 pints bid invitation No 49-1425 issue date Mar 10 delivery 90 days.

Altimeter 160 each bid invitation No. 49-1428 issue date Mar 14 delivery 30 days.

Nut, 1-16 items, bid invitation No 49-1420 issue date Mar 9 delivery 20 percent monthly

Rubber Cement 23,376 quarts bid invitation No 49-1426 issue date Mar 10 delivery 180 days

Parachute Assembly 1-2 items, bid invitation No 49-1429 issue date Mar 14 delivery by May 1

Bolt, 1-61 items bid invitation No 49 1436 issue date Mar 14 delivery 60 days.

Tire Removing Kit 300 each bid invitation No 49-1432 issue date Mar 14 delivery by Apr 15

Parachute Assembly 359 each bid invitation No 49 1410 issue date Mar 14 delivery by May 1

Washer 1-14 items bid invitation No 49 1418 issue date Mar 14 delivery 20 percent monthly

Developing Rack 700 each invitation No 49-1411 issue date Mar 7 delivery 30 days after approval

Photographic Equipment 1 44 items bid invitation No 49 1415 issue date Mar 7 delivery 30 days

Crystal Quartz 408 each bid invitation No. 49 1413 issue date Mar 8 delivery 60 days

Aluminum Alloy Sheet 30,000 lb bid invitation No 49 1419 issue date Mar 9, delivery 90 days

Packing 1 11 items bid invitation No 49-1423 issue date Mar 10 delivery 20 percent monthly

Paint Remover 1872 gal bid invitation No 49-1426 issue date Mar 10 delivery by May 1

Flying Suits Shoes 1 17 items bid invitation No 49-1427 issue date Mar 14 delivery by June 15

Bolt 168,000 bid invitation No 49-1437 issue date Mar 11 delivery 20 percent monthly

Test Club 25 each bid invitation No 49 1434 issue date Mar 1 delivery best possible

Aluminum Wool 2980 lb bid invitation No 49-1435 issue date Mar 11 delivery 20 percent monthly

Capacitor 1720 each bid invitation No 49 1440 issue date Mar 11 delivery best possible

Connector 535 each bid invitation No 49 1441 issue date Mar 14 delivery best possible

Resistor 2460 each bid invitation No 49 1442 issue date Mar 14 delivery best possible.

Nut 1-11 items bid invitation No. 49-1444 issue date Mar 14 delivery 90 days

Label Cement 10,000 gal bid invitation No 49 1445 issue date Mar 14 delivery 90 days.

Handle Assembly 1 8 items bid invitation No 49 1447 issue date Mar 14 delivery 20 percent monthly

Drive Assembly, Counter 1-2 items bid invitation No 49 1450 issue date Mar 14 delivery 60 days.

Stand Assembly 32 each bid invitation No. 49 1451 issue date Mar 14 delivery 90 days.

Luminous Material 1-2 items bid invitation No 49 1452 issue date Mar 14 delivery will be given later

Hamilton Standard 4997 each bid invitation No 49 1453 issue date Mar 14 30 days.

Mockup Trainer 1-7 items bid invitation No 49 1454 issue date Mar 14 delivery by Apr 30

Resistor Assembly, 1 6 items bid invitation No 49 1456 issue date Mar 14, delivery by July 1

Photographic Equipment 1 17 items bid invitation No 49 1421 issue date Mar 6 delivery 60 days.

Wrist Compass 1750 each bid invitation No 49-1458 issue date Mar 11 delivery best possible.

ENGINEERING

Designing For Gas Turbine Materials

Stress is no longer only major consideration. Use of high temperature alloys introduces new variables.

By M. H. Young*

Present-day design engineers have been brought up in a period where materials and their processing (particularly low alloy steels) have been carried to a high level of standardization and uniformity. With the introduction of high temperature materials, this situation has changed. Variables in melting and processing which affect physical and mechanical properties have not been fully explored.

Until all of these variables are understood, it is necessary to restrict the operating requirements of a high temperature alloy to conform to its presently known capacity and broaden its usefulness as further development permits.

Turbojet and turboprop engines—particularly the latter—have many requirements in common with piston type aircraft engines. Aside from the obvious similarities in problems involving such low alloy steel parts as shafts, gears, studs, nuts and bolts, it is also worth noting that our preoccupation with fatigue failures has not abated in the least with the advent of the new type engines.

Resonant vibration of such engine parts as compressor and turbine blades, sheet metal housings may produce fatigue stresses at higher frequencies and from new sources, but it may cause fatigue failures more difficult to track down and eliminate than those common to piston engines.

▶ **Significance of Temperature**—Chief concern at the moment, however, has to do with metallurgical and design problems which are unique in gas turbine engines and principal discussion centers around the combustion and expansion sections of these power plants, where the new materials are required.

Aircraft engine development has been distinctive in the practice of strengthening parts only when experimental engine testing has indicated the necessity, as a means of avoiding unnecessary weight. Such testing is always more severe than required for service operation, in order to shorten the development time and provide a safety factor under normal conditions.

It is natural that this practice has also been applied to aircraft gas turbines, but here it should be used with reservations that are based on the fundamentals of high temperature metallurgy. These fundamentals must be understood as working knowledge for every design engineer connected with these engines.

First, we are no longer dealing with stress as the only major design consideration for materials. When operating temperatures pass about 1000 F, we must also pay equal attention to exact temperature and to time at temperature.

* Based on a paper delivered at 17th Annual Meeting of the Institute of the Aeronautical Sciences, New York City. Mr. Young is Chief, Materials Laboratory, Wright Aeronautical Corp.

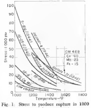


Fig. 1. Stress to produce rupture in 1000 hr. vs temperature for common heat resistant alloys. Dates show when material became commercially available. Lower four curves represent prewar materials.

This means that we have three variables to be considered when we apply materials to parts operating at high temperatures—stress, temperature and time at temperature. Each of these factors must be the subject of painstaking investigation such as previously reserved for stress analysis alone.

▶ **Careful Selection**—In Fig. 1 it is to be noted that on the basis of the stress to produce rupture in 1000 hr. at the temperatures shown, two well-known alloys in the forgeable group, S-816 and Inconel X, and two cast alloys, Stellites 21 and 31 are the best of the materials represented. It is seen that of the four, Inconel X is decidedly superior in strength at temperatures up to about 1450 F, but above this it loses strength more rapidly than the other three materials, becoming the poorest of the group just under 1550 F.

This general relationship holds true even for times much under 1000 hr. although cross-over temperatures may shift upward for shorter times.

Fig. 2 shows the effect of time under stress and temperature. The greater stability of S-816 over Inconel X at 1500 F is indicated by the fact that while the latter is initially stronger, it falls lower than S-816 after a time of less than 1000 hr.

This affords an excellent example of the necessity for a new and thorough understanding of high temperature materials on the part of design engineers.

If a particular engine design calls for a maximum turbine blade temperature of 1400 F, the metallurgist may rightly recommend a material such as Inconel X.

When the engine is under development in the test cell, it is quite possible that abnormally high power operation may send the blade temperature above 1400 F. If S-816 is found to operate better than Inconel X during this type of testing, it is possible that unless the situation is well understood, the engine will end up with S-816 turbine blades operating in service in a temperature range where Inconel X is decidedly superior.

From Figs. 2 and 3, it is also seen that operating life of such parts as turbine blades must be decided upon in advance, or we run the risk of choosing and designing around a material whose lack of stability at the operating temperature make it superior to other possible alloys for only part of its expected operating life.

▶ **Creep Rate Consideration**—The general problem of high temperature materials has been simplified in this discussion of the fundamental relationship of stress, time and temperature. Obviously such factors as oxidation and corrosion resistance enter in.

Tungsten and molybdenum, for example, might be very valuable materials as such if they did not burn up rapidly in oxidizing atmospheres at relatively low temperatures. Rates of plastic deformation, or creep rates, of the various alloys mentioned bear the same general relationships as rupture strength and were omitted from the illustrations for that reason, even though they may be more pertinent as specific design information.

Creep rates of high temperature alloys become extremely important in considering design stresses and materials for high temperature bolting. It is easy for the designer to forget that at temperatures over 1000 F, residual tension in a bolt or capscrew, and hence the clamping stress, will usually drop appreciably as a result of creep.

Fig. 3 shows this effect for a common high temperature bolting material as a function of temperature and time, with a room temperature pre-stress of 50,000 psi.

Along the same lines, it is necessary to remember that differential expansion of dissimilar materials held together by a bolt may introduce stresses beyond those planned with loosening or rupture of the bolt as a consequence.

▶ **Thermal Gradients**—The subject of thermal stresses deserves major attention from designers and metallurgists. We have just mentioned an example of how thermal stress may endanger the

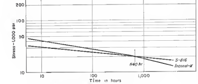


Fig. 2. Stress-rupture time at 1500 F., Inconel X vs S-816.

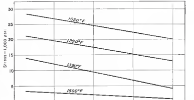


Fig. 3. Residual stress vs time for hot rolled and stress relieved 19 9DL. Limiting deformation equivalent to that produced by 50,000 psi at room temperature.

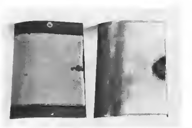


Fig. 4. Blade cracks produced by thermal fatigue machine. Blade, left, is ceramic coated.

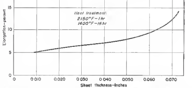


Fig. 5. Plot for S-590 sheet shows trend toward decreasing ductility with decreasing gage.

proper functioning of a part, but there are other cases just as important and less understood. Thus, a turbine disk may be designed around an adequate material from the standpoint of mechanical loading, but to the loads imposed by centrifugal action must be added those substantial loads caused by the thermal gradient from rim to hub.

This implies the desirability of using a disk material of low coefficient of expansion, a characteristic not readily obtainable in most alloys otherwise suited to do the job.

Further, if turbine blades are attached by welding, steep thermal gradients from rim to hub may cause repeated plastic compression of the rim with resultant residual tension when the disk is cool, and thus cause progression of inter-blade cracks through the weld and into the disk.

Advantages of the coolest possible turbine disk, or the least possible thermal gradient in the turbine disk, are obvious in view of the potential improvement in durability and decrease in weight.

Other examples of engine parts which may be critical from the standpoint of thermal stresses are turbine rotor and stator blades, combustion chamber liners, and sheet metal shrouding components. These parts may become critical because of the possibility of extreme thermal gradients in local areas within the part, with the resulting stress causing warping and cracking.

It may not be necessary to explain that the stress originates from plastic compression within a hot area which is wholly or partially surrounded by cooler metal. When the hot area cools, residual tension is produced which may cause cracking, particularly when the cycle is repeated many times.

► **Blade Factors**—With parts of thin section the hot area will usually bulge plastically to relieve the compression and become permanently deformed.

Fig. 4 shows turbine stator blades which have been subjected to cyclic thermal stress in a test rig. Here the thermal gradient is extreme at the thin trailing edge, midway between the inner and outer blade shrouds. Cracking of the type pictured can be produced without any restraint at the blade ends. Only cure for this type of trouble is a lessened peak temperature or thermal gradient, assuming the material selected is the best available.

In this case the best material will have high short time (less than 1 hr under stress to rupture) tensile strength, high thermal conductivity and low coefficient of expansion.

Because of the relatively low conductivity and high coefficient of expansion of the heat resistant alloys, little can be done metallurgically but to pick an alloy having the best short time strength at the peak operating temperature. It is more effective to reduce thermal stresses by insulating the blade by a ceramic, as shown in Fig. 4 or to increase the cross section of the blade as a means of reducing the thermal gradient.

It is even more obvious that uniformity of gas temperature over the blade is of fundamental importance. In any event, thermal stress may be of more importance in some cases than mechanical stress, even for rotating turbine blades.

With a thermal fatigue machine used to compare materials by alternate cooling and heating cycles, blades or otherwise thin edged specimens are mounted on a traveling carriage and held over a hot flame for 1 min. and then moved to a cool air jet for the same period. Thermocouples are attached to the specimen and a continuous recorder keeps the cycle and temperature history. Frequent observation is necessary to determine the beginning and progression of cracks.

► **Sheet Metal Components**—Design of sheet metal parts such as combustion chamber liners requires consideration of thermal differentials as a primary cause of stress as well as acceptance of the fact that sheet metal edges are sources of stress concentration. Fig. 5 shows percent elongation at failure vs. sheet metal thickness for S-590, a well-known heat resistant alloy.

The apparent trend toward a decrease in ductility with decreasing sheet thickness becomes even more marked if cut edges are not carefully deburred, and is most marked for materials of lower nominal ductility or high notch sensitivity.

With respect to thermal stresses in sheet metal, it has been previously pointed out that light cross sections along with the usual low thermal conductivity and high coefficients of expansion of heat resistant sheet materials make for susceptibility to thermal cracking. Certainly it is not advisable to have discontinuities in sheet metal parts where hot spots may occur near an edge, thus causing high stresses in areas least able to adjust to such conditions.

The above arguments apply equally well to turbine blades, where, if the trailing edges of the blades were reduced to the thickness ideal for aerodynamic reasons, they would probably be too thin for durability in engine operation.

Many more examples of the need for more than the normal overlap in working knowledge of gas turbine metallurgy and design could be cited. Behind most of the preceding cases there is an implication of the great importance of having temperature, stress and time factors well determined for turbine parts.

operating at elevated temperatures. Instrumentation necessary for obtaining such information during experimental engine testing should merit even more investment in time and money than it has in the past for piston type engines, particularly since instrumenting parts such as turbine rotor disks and blades for reliable temperature and stress determinations is still far from standard practice and a challenging subject for engineering development in itself.

▶ **Development Data**—Referring again to Fig. 1, it will be seen that certain lower strength materials have been included for comparative purposes. With the exception of the Timken 16-25-6 alloy, the lower-positioned lower strength materials are of pre-World War II vintage. However, it may surprise some to realize that even the latest high temperature casting alloy, Stellite 31, was available (not commercially) in 1944, having been developed through modification of Vitallium (Stellite 21) an early alloy originated for medical usage prior to 1942. Considering the availability dates for each of the four top-positioned alloys, it is apparent that we should not expect to maintain the past development rate of high temperature alloys.

The great improvement evidenced by the increase in strength from one of the best prewar heat resistant alloys, 18-8 Mo, to S-816, one of the best examples of the current wrought alloys, has been largely a result of exploiting our reserve of basic information when necessity demanded.

The postwar years have been marked by large scale, coordinated efforts in metallurgical research devoted to high temperature alloys development, but in spite of this unprecedented activity, there have been no startling developments. A chromium base alloy, CM469, has shown some improvement as indicated by a 1600 F, 1000-hr rupture point on Fig. 1, but the alloy is brittle at room temperature and not yet castable on a commercial basis.

Ceramic coating of alloy parts has been of specialized value, but has not proved to be a permanent protection. Solid ceramic turbine blades have, for some time, seemed to offer the possibility of increased operating temperatures, but their brittleness and low resistance to thermal shock have prevented their extended use in practice. Metal bonded ceramics may well be a more immediate answer to the use of ceramic turbine parts.

Here again, there is only meagre evidence to support such a contention, and generally the only safe prediction for the future is that we must certainly know more about the materials already in use.

▶ **Designing For Conservation**—Many

of our high temperature alloys are strategic because they contain nickel, cobalt, tungsten, columbium and other materials virtually non-existent in the United States. It is doubtful that even stockpiling can supply enough of these critical constituents to wage another successful war. In our zeal to produce the best in power and range and beat our competitors, we may be inclined to brush aside this fact.

Experience has already shown that some parts such as rotors can be made to operate cooler than was first anticipated. Design ingenuity on hollow blades and cooling ducts can lower temperatures to the extent of permitting materials that will substantially save strategic elements. It is likely that many parts such as tailcones or even liners can be fabricated of low carbon steels coated with ceramic.

The importance of directing our design, wherever possible, to conserve critical materials must not be overlooked.

With proper design consideration for the limitations of our present alloys, and with improving background for understanding these limitations, we should be able to effect substantial improvement in the performance of future turbojets and turboprops without resorting to wishful thinking about the Utopian material that would permit unlimited power and efficiency with a minimum of drafting room labor.

German Drawings

Approximately 185,000 captured German aircraft design drawings are now on file at Wright-Patterson Air Force Base, Ohio.

Of this total, about 60,000 have been classified as holding special interest for engineers in the fields of aircraft, swept-wings, rocket engines and guided missiles.

Drawings are available to qualified government agencies and industry contractors participating in aircraft research and development under government contract.

Originally, about one million drawings were shipped to Wright Field from the Air Documents Research Center in London.

It has required more than a year to examine and classify these drawings with the result that about 60,000 are classed as "priority one" and 125,000 "priority two."

Information on the drawings may be obtained from Commanding General, Air Material Command, Wright-Patterson Air Force Base, Dayton, Ohio. Requests should be directed to the attention of Central Air Documents Office, MCIDXD.

Heliograph Traces Rocket Path

Missile-carried instrument affords valuable record of flight attitude. Aids in solution of control problem.

A motion picture heliograph system developed by G M Giannini & Co, Pasadena, Calif, has provided the U S Signal Corps with what the manufacturer describes as the first complete record of what happens to V 2 rockets as they streak through outer space

The importance of this data to designers and constructors of missiles is emphasized because among the complex problems of missile flight that of accurate control is a vital consideration For, without accurate guidance, a missile's range, speed, and damage potential are of little practical value

And in keeping with the growing philosophy that ultimately missiles may, because of their tremendous offensive and defensive potential, take over the function of military aircraft, precise control becomes of paramount importance

A rocket is likely to go into unpredictable gyrations once it is free of the sticky envelope of the earth's stratosphere It may wobble, spin, turn end-over-end The best-fired and seemingly most carefully balanced V-2 may reach the peak of its trajectory sliding tail first

▶ **Proving at White Sands**—By recording the attitudes of rockets at ¼ sec intervals throughout their flights, heliograph films now give highly accurate information on missile misbehavior at extreme altitudes, and constitute a major phase of corrective research to assure the success of very long range rocket flight Until missile developers learn how to keep their vehicles rock-steady in attitude throughout their trajectories the prospect of human inhabited "space ships" must be considered remote

Although obscured until now by military secrecy, the Giannini heliograph has been in use at White Sands Proving Ground since October, 1947, following development of a system originated by Dr W B Klemperer for use in experimental stages of an Army Ordnance

Above Heliograph installed on V 2 missile. Below Essential assembled components of the V-2 heliograph units

project assigned to Douglas Aircraft.

▶ Heliograph's Function—In a way, the heliograph records of erratic rocket behavior must be considered to be a "bonus," for the instruments were installed in V-2s primarily for other purposes. The original job of the heliograph was to gain aspect data which would coordinate with the taking of other instrumentation data.

Thus, Johns Hopkins University researchers used V-2 flights to collect vacuum bottle samples of upper air at precise altitudes, but they had no way of knowing whether the sample bottle intakes were exposed directly to the atmosphere or blanketed by some portion of the rocket structure at the moment of opening. Heliograph records would establish the aspect of the rocket and position of air sample bottle, at the exact moment of opening.

▶ How It Operates—While it falls within the category of high precision instruments, the heliograph is simple in principle of operation.

Submerged in a rocket fin and viewing the landscape on either side through 1 mm lenses mounted flush with the skin, it takes motion pictures showing relative positions of sun and horizon as they would be viewed from the speeding missile throughout its journey. No definition of ground detail is required—only the horizon line.

After the recovered film is developed, successive picture frames are enlarged and superimposed upon a calibrated grid of latitude and longitude lines. Involved mathematical computations then produce a description of the missile's flight attitude at the moment of each photograph.

In the V-2 installation, three heliographs are employed, one in each of three fins, so that an uninterrupted record is obtained even though sun-horizon images may be lost to one or two of the instruments due to a shift of the missile's attitude.

▶ Makeup—The instrument is a three component unit—a battery box, armored camera case, and an optical box which, when installed in the fin permits two conical lenses of original design to fit into small openings cut in the skin. A flat surface, at the apex of the lens cone, having flush exposure in the fin aperture, serves as an "eye" with a vision angle of more than 150 deg.

Refracted images of sun and horizon are caught on a mat-ground spherical base of the lens. It is this mat surface image, continually changing, which the electrically operated motion picture camera sees through reflecting mirrors in the lens box. Each frame of film also records the face of a stop watch mounted in the optical box.

Camera and watch are started by electrical remote control just before the

firing, and once the missile is under way the record is continuous.

▶ Film Disclosures—Viewing the film in motion picture sequence induces reactions one might have in riding with the missile, according to the manufacturer, and can become startling when sun and horizon suddenly begin bobbing and whirling with an unforeseen spin or tumble of the vehicle. A jolting sweep of horizon and sun may mark disintegration of the missile on its way down. A sudden blanking of the film—the end of the flight.

Of particular interest to rocket experts is the manner in which heliograph records have marked disintegration of some V-2s when they "splashed" into the upper surface of the stratosphere, some 50 mi. up. The impact evidently is violent, almost comparable to hitting the surface of water at high speed.

Heliograph records now give tangible support to German V-2 theorists who proposed during the war that a rocket's range might be lengthened appreciably by "bouncing" it along the surface of the stratosphere in the manner of skipping a heavy stone upon the surface of water.

▶ Interpretation of Data—Recovering the camera and its film from the rubble of a 30-ft. impact crater is the least of the heliograph analyst's problems. Interpreting each picture involves the time at which it was exposed, altitude, and exact position of the sun at the time of flight.

Determining a V-2's attitude throughout a flight formerly was a tedious job for a team of mathematicians. Recently, however, this chore, which previously consumed up to six weeks in calibration of a single flight, has been eased by use of an armillary sphere. In effect a "spherical slide rule," it is a globe with lines of longitude and latitude and having superimposed, graduated, movable arcs for reading results directly.

Recovery of film in good condition is due chiefly of immersion of the camera in shock-distributing silicone material—General Electric Co.'s "bouncing putty"—within the armored housing. J. Delmonte, Giannini heliograph project engineer, reports that some cameras have been recovered in operable condition and in one instance a recording stop watch resumed ticking upon rewinding after its 90-mi. drop.

What makes the V-2s deviate from an arrow true flight?

To date, no published conclusions are available from the White Sands laboratories, and one can only guess that once the missile is free of the atmosphere, free of stabilizing forces of air on the fins and stabilizing thrust from the rocket jet, the slightest off axis force might start it spinning or tumbling.

Theory of the Inversely Tapered Wing

New configuration may be answer to poor stability of swept wing jet fighters and bombers at low speeds.

By Robert McLarren

The use of sweep to increase the critical Mach number of high-speed aircraft wings has proved one of the truly significant developments in aeronautical history.

Because pressure distribution over a wing is affected solely by the component of the airflow normal to the leading edge, the effective "velocity" of the flow is only V cos β, in which V is stream velocity and β is the angle of wing sweep.

Since the cosine of an angle is always less than unity, flow velocity along the wing normal to the leading edge is always less than that along the chord, thereby delaying the initial occurrence of shock losses and minimizing their effect throughout the range of speed of the airplane.

▶ **Sweep Brings Problems**—However, at the low end of the airplane speed range, wing sweep creates serious difficulties (AVIATION WEEK, Mar 8, 1948). Sweep assists the spanwise drift of the boundary layer towards the tip with the result that the layer thickens in this region, with accompanying susceptibility to premature stalling.

Effect of this premature stall is to cause a serious loss of aileron effectiveness at a time when it is most needed and create longitudinal stability difficulties through a substantial shift in the wing center of pressure.

Considerable work has been done towards solution of this problem and a wide selection of results is available. These include the use of slots and slats, wing twist, flat plate air separators, variations in section, etc., having different degrees of effectiveness.

One of the most recent and most promising solutions is the use of planform changes involving an inverse wing taper—a planform in which the tip chord is larger than the root chord.

The reasons for the improvement in stall characteristics attending this method are as complex as they are interesting.

▶ **Rectangular Planform**—Consider, first, a rectangular, unswept wing as shown in Fig 1a. The distribution of lift coefficient along the span of this wing is shown in Fig 1b. It will be seen that the value of the lift coefficient continues constant along the span from the root until effects of tip losses begin to be felt. Outboard of this point the lift coefficient falls off more rapidly until it reaches zero at the tip.

Fig 1c shows the accompanying actual lift distribution along the span. Since the chord is constant along the span, this curve is identical to that shown in Fig 1b.

▶ **Tapered Wing**—Taking the same wing area and section, taper is introduced and its effect is shown in Fig 2. An infinite taper ratio has been selected to illustrate the ultimate effect and Fig 2a illustrates this planform.

Fig 2b illustrates the substantial shift of the lift coefficient distribution towards the tip. Theoretically, the lift coefficient approaches infinity exactly at the tip but the graph illustrates the more practical effects in which the lift coefficient reaches some high value and then suddenly drops to zero. Thus, wing taper "loads up" the tip aerodynamically.

However, the physical result of this effect is shown in Fig 2c showing the actual lift distribution on the tapered wing. Although the lift coefficient increases towards the tip, the sharp reduction in wing chord towards the tip results in the lift distribution shown, in which the root carries the greatest load and the tip a load that ultimately reaches zero.

It was this favorable load distribution that caused stress analysts to advocate its adoption and the industry to broaden its use until today it is safe to say all aircraft, with the exception of certain lightly-loaded personal types, use tapered wings.

▶ **Taper Drawback**—But Fig 2b also indicates a serious defection inherent in the tapered wing. The dotted horizontal line indicates the stalling lift coefficient of the basic airfoil section. As the wing's angle of attack is increased, it is seen that the first portion of the wing lift coefficient distribution to coincide with this line is the tip section.

As this distribution line continues to rise, the tip is stalled and this stall progresses inboard ultimately to the root. Slope of the distribution line is an index to the rapidity of the spread of the stall.

However, as stated earlier, the planform in Fig 2a illustrates an infinite taper so that more moderate tapers produce more moderate distribution slopes, indicating far more gradual spread of the stall.

▶ **Inverse Taper**—It would follow, from Fig 2, that the opposite effect would result through the use of inverse taper. Fig. 3a illustrates a planform with infinite inverse taper. Fig 3b shows, in general, this expected reversal of characteristics. The lift coefficient distribution has been shifted towards the root.

Fig 3c expresses this effect in terms of the actual lift on the airplane and illustrates the substantial shift in load towards the tip. This paradox obtains from the fact that although the highest lift coefficients are near the root this area has the shortest chord, with the opposite effect existing near the root.

Again, the dotted horizontal line indicates the maximum lift coefficient of the basic profile, and it is seen that the root section stalls first with the tip section remaining unstalled until the wing has lost its lift. A glance at Fig 3c will also show that this unstalled tip section also supports the greatest amount of lift.

▶ **Swept Wing**—Fig 4 extends these data to the swept wing case, Fig 4a illustrating the rectangular wing of Fig 1 swept to an angle of 30 deg. One curve, Fig 4b, is used to show the typical loss in both lift coefficient and lift along the root section, and the spanwise shift of the load distribution. Reference to Fig 2 will show that sweeping a simple rectangular wing has much the same effect as tapering an unswept wing.

Now, by adding taper to this swept wing, the lift coefficient distribution is further shifted towards the tip but the reduction in area at the tip and its addition in the root section relieves much

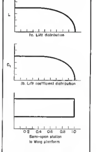


Fig 1. Graphs showing typical distribution over rectangular wing

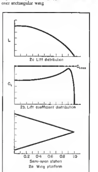


Fig 2. Typical distribution over wing having tapered planform

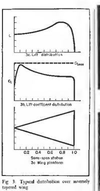


Fig 3. Typical distribution over inversely tapered wing

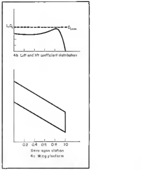


Fig 4. Graph illustrating typical distribution over swept wing

of this effect on the problem of the structural design of such wings. But the aerodynamic effects remain to create the stability and control difficulties outlined previously

▶ **Sweep, Inverse Taper**—It is at this point that the deductions obtained with the unswept inversely tapered wing are brought into the problem. Fig. 5a illustrates a typical example of a swept, inversely-tapered airfoil. Fig. 5b shows how the combination of Fig. 3 and Fig. 5 produces a span lift distribution not unlike that shown in Fig. 1. In this design, the lift coefficient has been shifted inboard thereby relieving the tip section of its dangerous stalling characteristics

Throughout this analysis, the simple case has been assumed. In actual practice a wide variety of other effects are brought into play that complicate the problem and compromise the simple effects outlined

For example, the greater chord at the wingtip will be operating at a slightly higher Reynolds number than that at the root, reducing the degree to which the lift coefficient distribution is shifted inboard

▶ **Stress Considerations**—From the foregoing there would appear little wonder that aerodynamicists were early attracted to the inversely-tapered planform as the solution to the problem of tip stall. But to the stress analyst such a planform is sheer nightmare

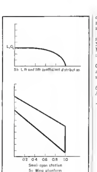


Fig 5. Typical distribution over inversely tapered, swept wing

The load has been shifted towards the tip while the root area has simultaneously shrunk to a greatly reduced size

Add to this the necessity for very thin airfoil sections, the well known problem of swept wing torsion and its effects on load distribution and you have an idea of the stressman's early reaction

However, like most aircraft design problems, this apparent conflict between aerodynamics and structures can be solved with a little cooperation. For example the spanwise load distribution can be controlled with some precision by the proper selection of profiles and section thicknesses along the span

Not only does this provide some relief to the problem of structural design but it can produce a sloping maximum lift coefficient line so that the angle of attack of the initial stall can be located at a more desirable spanwise point

It is in these design compromises that the degree of effectiveness of this new method of controlling swept wing stalling characteristics is established. In many cases it is entirely possible that no aerodynamic benefits will accrue at the same time that structural penalties are being paid. High speed characteristics of the wing can be greatly impaired by improper selection of taper ratio, aspect ratio, spanwise profile variation, twist, etc. But there remains little question that, properly used, inverse wing taper can comprise a broad step forward in solving the problems of the swept wing at low speeds

The U.S. Air Force, at least, is willing to give it a try, and the Republic XF-91 supersonic fighter is now at Muroc Air Force Base, Calif. awaiting its first test flight.

The tiny craft is powered by both a General Electric J-47A turbojet engine and two types of rocket motors for high speed acceleration

The J-47A engine develops almost 6000 lb. thrust with water injection. Alternately, the engine may be an Allison J-35, producing 5500 lb. thrust with water injection

Span of the craft is about 30 ft., length is more than 45 ft. Weight is 15-20,000 lb.

Its wings feature inverse taper that may not only enable it to fly faster than any other combat aircraft in the world but to takeoff and land slowly under perfect control of the pilot

If its flight tests prove this to be the case, then the simple expedient of "turning the wing around" on the fuselage will assuredly receive wide application in the future

10th edition
LITTLE KNOWN FACTS

AIR TRANSPORT
FACTS AND FIGURES

OPERATIONS OF THE SCHEDULED AIRLINES IN 1948

MORE progress was made during 1948 in almost every phase of scheduled airline operations than in any year in the history of the industry

The industry profit-and-loss sheet, which was seriously depressed in 1947, showed genuine recovery and it was estimated that, when final figures are in, the industry might conclude 1948 with a $2 million to $5 million loss compared with a loss of nearly $22 million in 1947

Spectacular improvement was made during 1948 in airline schedule dependability, the safety record was one of the three best in 13 years, passenger relations reached a new high in courtesy and service, air mail and air parcel post set new marks, and the phenomenal growth of air freight continued both in volume and service to shippers

The scope of the scheduled airlines' operations is illustrated by the fact that the estimated number of arrivals and departures completed at airports throughout the country in fiscal 1948 exceeded 3,052,000, an average of nearly 8400 takeoffs and landings per day, slightly more than 348 per hour, or almost one every ten seconds Only four of the 3 million operations resulted in fatalities to passengers

Finance—It was estimated that an increase of 13 percent over 1947 gross revenues would be shown in

Chart, illustrating total domestic and international revenue miles flown, demonstrates growth of air transport during the last 17 years First bar (1932) represents 51,171,887 revenue miles flown, last bar (1948), 436,569,000.

the final 1948 figures for the scheduled airlines of the United States. These include domestic trunk and feeder lines and U.S. flag international carriers.

Operating expenses for the lines increased approximately 10 per cent in 1948.

The total gross revenue of the scheduled airlines for 1948 was estimated at $643,542,000 and total operating expenses at $650,277,000. If the nearly $5 million in retroactive mail pay, announced by the Civil Aeronautics Board in December, is indicated in 1948 revenues, total industry loss would be reduced to about $1,735,000.

From 1941, the last prewar year, to the present time airline assets have expanded more than five times. However, during this same period long-term debt has risen from approximately $1.5 million to more than $173 million. The greater part of this increase has been in the last three years and is accounted for by the replacement of older equipment with newer and more economical types. The first full postwar year, 1946, saw rapid airline expansion of assets both in flight equipment and other operating property. There are many among air transport men who believe that the present equipment is likely to remain substantially unchanged for the next few years and that correspondingly there may be but a small increase in total assets or in long-term debt within the near future.

Operational Improvements—For the first time, during 1948, it was possible to measure the effects of several programs developed by the Air Transport Assn., the military and the Civil Aeronautics Administration for the betterment of airline operations.

These programs include the installation of the Instrument Landing System, the Ground Controlled Approach System, high-intensity approach lighting, very high frequency radio communications, and various other modern navigational devices.

Results of these programs in 1948 are shown in the following facts:

Flight cancellations due to weather below acceptable operating limits were reduced by 50 percent, delays caused by waiting for weather improvement reduced by 62 percent, cargo and baggage handling delays reduced by 52 percent, passenger and ticketing delays reduced by 54 percent, servicing and fueling delays reduced by 42 percent.

FLIGHT OPERATIONS IMPROVED IN 1948		
Cancellations Due to Weather	Reduced	50%
Delays Due to Weather	"	62%
Baggage-Handling Delays	"	52%
Passenger & Ticketing Delays	"	54%
Servicing & Fueling Delays	"	42%

Delays and cancellations due to air traffic congestion were substantially reduced throughout the airline system. Following are examples of this improvement at LaGuardia Airport in New York City.

During the winter period 1946-47, there were 3877 scheduled flights cancelled or unable to land due to traffic congestion. In the same period one year later (1947-48), there were *NO* cancellations caused by air traffic congestion.

During the winter period 1946-47, a total of 4582 scheduled flights were delayed at LaGuardia due to traffic congestion. In the same period a year later (1947-48) only 555 flights were so delayed, an elimination of 88 percent of all flight delays for this reason.

The average time per aircraft delayed at LaGuardia was reduced during the year from 33 minutes to 11 minutes. The airport capacity at LaGuardia was increased from 10 planes in and out per hour in 1947 to 30 per hour in 1948.

New to this edition of Facts and Figures are tables on domestic airline aircraft utilization. Close analysis of the table showing average miles flown per day by the various types of aircraft employed by the domestic airlines gives an excellent picture of utilization during the war of the DC-3 and the increasing use made in the postwar period of the newer types of aircraft. Between 1939 and the peak war year of 1944, daily mileage flown by DC-3s increased more than 62 percent. On the other hand, the DC-6 has increased its daily miles by 32 percent in two years and the Constellation by 54 percent in three years.

Safety—During 1948 there were four accidents on scheduled domestic airline routes, involving 83 passenger fatalities, while in 1947 there were five accidents involving 199 passenger fatalities.

The domestic scheduled airline record for 1948 was 1.4 passenger fatalities for each 100 million passenger miles (equal to one passenger flying around the earth at the Equator 4000 times) compared to 3.2 passenger fatalities per 100 million passenger miles flown in 1947.

The U.S. flag international carriers completed the year with one accident on scheduled flights, involving 20 fatalities. This gave the international carriers a record of 1.06 passenger fatalities per 100 million passenger miles compared with 1.08 in 1947.

Traffic—Total revenue passenger miles declined, during 1948, approximately 1.3 percent, with domestic airlines showing a decrease of 3.5 percent and international carriers an increase of 4 percent. Total revenues for passenger traffic in 1948 gained approximately 7 percent.

Revenue passenger miles for 1948 totaled 7,768,786,000 as compared with 7,867,138,000 for 1947.

The total operating revenues for 1948 were $643,541,849 as compared with $569,940,600 for 1947. Total operating expenses for 1948 were $650,277,263 as compared with $591,741,861 for 1947.

The scheduled domestic airlines continued to increase their portion of the first-class travel market in 1948, their percentage being nearly 35 percent as compared with approximately 32 percent in 1947.

The number of planes in the domestic airline fleet in 1948 increased from 810 in 1947 to 862 in 1948, and the average available seats reached 32.1 per plane as compared to 29.93 in 1947. The domestic lines carried 13,002,000 passengers in 1948 a total of 337,872,000 revenue miles for a daily average of revenue miles flown of 925,677.

The U.S. flag lines operating internationally increased their fleet from 154 planes in 1947 to 203 planes in 1948. They carried 1,324,000 passengers a total of 98,697,000 revenue miles for a daily average of revenue miles totaling 270,403.

A new Universal Air Travel Plan which enables travelers to buy air transportation on credit almost anywhere in the world, was inaugurated on Oct. 1, 1948 by agreement between the international airlines and the domestic airlines of North America.

According to terms of the plan, a credit card secured from one airline will be honored for transportation by any of the approximately 100 scheduled airlines operating in the U.S. and throughout the world.

Air Mail, Air Express and Air Freight—In 1948, as in 1947, conspicuous increases were shown in the transport of commodities by both air express and air freight. The ton miles of express and freight for domestic trunk lines and international U.S. flag carriers were estimated at 144,700,000 as compared with 96,638,000 in the preceding year—a gain of almost 50 percent.

Domestic air freight alone showed a gain of almost 100 percent from 35,213,550 ton miles in 1947 to 68,760,000 in 1948.

Air mail ton miles rose from 36,413,000 in 1947 to 44,159,000 in 1948.

The December 1948 volume of domestic air mail was 2¾ times the volume of domestic air mail in September 1946, the last month of the 8 cent rate. The volume in December 1948 also was approximately 12 per cent higher than the wartime peak of air mail which was reached in March 1945. The unusual rise in air mail volume, as indicated in the December figures, was due to the increasing acceptance of air mail by the public, and to a consistent growth in the use of air parcel post.

Air Cargo, Inc.—Provision of ground transportation service for the pick-up and delivery of air cargo at the hundreds of points served by the scheduled airlines throughout the United States was completed during 1948 by Air Cargo, Inc., the airlines' freight organization.

Air Cargo, Inc. now directly provides service at practically all points served by more than one airline. Smaller cities adjacent to points directly served by the air carriers but included in the door-to-door pick-up and delivery pattern total over 2000 additional points.

Features of the Air Cargo Inc. program include downtown terminals for shippers' convenience in practically every city now served, and expedited special service when required by shippers. Air Cargo, Inc. now has approximately 700 vehicles used daily in air cargo pick-up and delivery for the scheduled airlines.

Air Cargo, Inc. also set up during the year contracts with a number of national trucking organizations which provide for joint air-motor carrier transportation in many states and involving more than 5000 motor carriers.

Of the total operating revenues of the airlines for 1948, it is estimated that passenger traffic contributed 77.37 percent, mail 15.5 percent, freight and express 7.13 percent.

Planes and Equipment—Many airlines virtually completed their delivery programs of new planes during 1948. Scores of new-type Lockheed Constellations, Douglas DC-6s, Convair 240s and Martin 202s made their appearance on the nation's airways and added new standards of speed, convenience and comfort for air travelers. Boeing's new double-deck Stratocruiser is scheduled to begin operations on several of the airlines during 1949.

Nearly all of the scheduled airlines added many items of new equipment, improving seating and lighting comfort, air conditioning and other devices affecting passenger relations during the year. Air terminals and hangars were constructed and improved, food services expanded and bettered, cargo handling facilities of all kinds installed and broadened.

Airports—There were an estimated 6100 civil airports in the United States at the end of 1948, an increase of 16 percent from the 5258 at the beginning of the year. Certificated airline stops totaled 773, of which 249 had not begun operation because of incomplete construction and other factors.

ABOUT THE AUTHOR

Emory Scott Land, Vice Admiral, U.S.N. (Retired), is president of the Air Transport Assn. of America. He served in the Navy, from his graduation from Annapolis in 1902, until 1937, when he became a member of the U.S. Maritime Commission. He was designated Chairman of the Commission in 1938 and also served as War Shipping Administrator during World War II.

During his Naval service, he was Assistant Chief of the Bureau of Aeronautics. He became a pilot at the age of 50 and devoted eighteen months' time to the Daniel Guggenheim Fund for the promotion of Aeronautics.

Scheduled airline use of the nation's airports was estimated at 16.3 percent as compared to 17.2 percent in 1946.

From the record of 1948 it would appear that the postwar readjustment period was about over for the airline industry. It has been the most trying period in the industry's lifetime.

None can say that the airlines failed to meet the tremendous problems produced by the circumstances of the 1945-1948 period with courage and determination. Their comeback was a tribute to the type of free-enterprise management which has made commercial aviation the strong competitive business it is.

With the addition of many new planes, with the continuing improvement of airline navigation and traffic control facilities, the commercial industry has been strengthened as an important element of national security. In case of emergency conditions, such as it met with such success during the early years of the last war, the industry now stands ready to offer the military approximately ten times the lift-capacity it had in 1941. In the growing stature of the Air Age, this component of the airline industry cannot be over-emphasized.

The air navigation and traffic control facilities, which the airlines, the military, and the civil aeronautics agencies have implemented during the past year at great expense, also are immediately available for military as well as commercial use, either to be integrated into the existing military system or to operate independently on a complementary basis.

The year ahead portends continuing progress in many branches of airline operations and management. Already very encouraging results are showing in the form of increasingly profitable business, as well as in "on-time" operations.

During 1948 the time required for many regularly scheduled flights was reduced again and again by the carefully tested new planes which were put into service. And flights were more comfortable and more regular, too.

The airline industry takes pride in the knowledge that, because of its own initiative and because of the cooperation it has received from civilian government agencies and the military, the United States continues to lead the world in commercial air transportation.

Our contribution to national defense should never be overlooked.

E. S. Land, President
Air Transport Association of America

PASSENGER-MILES, MAIL, EXPRESS AND FREIGHT TON-MILE

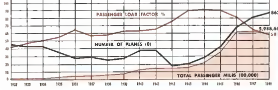
	Total Passenger Miles (000)	Passenger Load Factor	Air Mail Ton Miles	Express Ton Miles	Freight Ton Miles
1932	127,433	41 98	2,701,125	289,512	*
1933	174,820	46 77	2,567,924	422,860	*
1934	189,806	51 61	2,461,412	597,293	*
1935	316,336	54 76	4,132,708	1,097,602	*
1936	438,989	63 97	5,740,436	1,865,798	*
1937	481,116	57 54	6,698,230	2,162,488	*
1938	560,660	58 93	7,449,246	2,182,420	*
1939	755,118	62 14	8,610,726	2,713,099	*
1940	1,157,900	63.72	10,117,858	3,476,224	*
1941	1,506,303	64.32	13,118,015	5,258,551	*
1942	1,501,279	76.45	21,162,102	11,901,793	*
1943	1,670,935	89 98	36,061,868	15,139,359	*
1944	2,211,905	90 77	51,139,973	16,991,598	*
1945	3,408,290	89 33	65,092,921 (B)	21,793,432	1,403,420
1946	6,068,315	80 31	32,953,307 (B)	23,788,392	14,822,325
1947	6,307,690 (A)	65 12	33,086,175 (B)	28,766,659	35,911,554
1948 (Est)	5,988,668 (A)	58 25	37,567,000	30,637,879	69,023,000

(A)—This figure is revenue passengers only. All others include revenue and non-revenue passengers.
(B)—Does not include regular mail carried under special contract and foreign mail.
*—Not available.

NUMBER OF PLANES, SEATS AND MILES • DOMESTIC AIR LINES

	Number of Planes	Average Available Seats (D)	Total Passengers Carried	Route Miles (A)	Revenue Miles	Daily Average Revenue Miles Flown
1932	456	6 61	476,041	*	45,893,522	125,736
1933	418	7.59	502,218	*	49,256 320	134,949
1934	423	8 86	475,461	*	41 525,667	113,769
1935	363	10 33	762,820	*	55,918,151	153,200
1936	280	10 67	1,042,042	*	64,307,480	176,185
1937	291	12.52	1,130,338	*	66,791,079	182,989
1938	260	13 91	1,365,706	39,267	68,610,143	187,973
1939	276	14 66	1,895,793	39,782	82,924,922	227,192
1940	369	16 54	3,038,619	44,643	110,101,039	300,823
1941	370	17 54	4,141,748	46,453	134,405,836	368,235
1942	186	17 91	3,559,369	49,297	111,340,622	305,043
1943	204	18 34	3,484,203	54,502	105,354 810	288,643
1944	288	19 05	4,761,313	62,937	138,732,219	379,050
1945	421	19 68	7,605,856	66,466	208,969,279	572,519
1946	674	25 25	13,705,360	84,358	309,888 684	849,010
1947	810	29 93	12,890,208 (C)	110,716	325,054,389	890,560
1948	862 (B)	32,10	13,002,000	139,030	337,872,000	925,677

*—Not available
(A)—Includes duplication of routes (B)—Includes 293 aircraft listed on both domestic and foreign certificates (C)—Beginning 1947 only revenue passengers; before 1947 figures include revenue and non-revenue passengers (D)—Obtained by dividing available passenger seat miles by revenue miles flown in passenger service

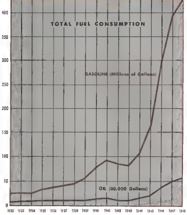


NUMBER OF PLANES, PASSENGERS AND MILES • INTERNATIONAL AIR LINES

	Number of Planes	Passengers Carried	Route Miles	Revenue Miles	Daily Average Rev Mi	Passenger (C) Mi (000)	Ton Mi (D) Express, Frt & Mail (000)
1932	108	71,519	19,574	5,278,365	14,422	20,754	*
1933	86	74,394	19,404	5,857,163	16,047	24,956	*
1934	99	96,804	22,192	7,539,106	20,655	36,844	*
1935	101	111,296	31,261	7,949 547	21,780	46,035	*
1936	94	87,723	31,990	6,904,246	18,864	41,829	*
1937	92	112 324	31,979	7,909,158	21,669	53,742	*
1938	73	109,265 (B)	34,968	7,042,503	19,295	53,799	*
1939	84	136,090	43,455	7,607,474	20,842	78,271	*
1940	68	170,179	53,322	9,651,733	26,371	104,495	*
1941	83	235,802	*	14,410,358	39,480	165,950	*
1942	68	276,200	*	18,681,059	51,181	240,314	*
1943	70	292 888	27,211	18,457,864	50,569	254,374	5,088
1944	70	356,662	29,708	22,272,638	60,854	322,123	6,207
1945	97	493,498	38,885	32,608,704	89,339	462,180	8,718
1946	147	1,066,414	66,419	59,375,572	162,673	1,130,196	15,090
1947	154	1,359,410	95,503	86,471,982	263,910	1,870,306	32,891
1948 (Est)	203 (A)	1,324,000 (B)	172,177	98,697,000	270,403	1,945,000	45,000

(A)—203 planes listed for exclusive foreign service In addition, 293 planes listed for domestic and international service
(B)—Revenue passengers only All other figures include revenue and non revenue passengers.
(C)—Includes revenue and non-revenue passengers.
(D)—No reports on ton mile basis made before 1943

FUEL CONSUMED



INTERNATIONAL

	Gasoline (Gallons)	Oil (Gallons)
1932	3,920,775	113,783
1933	4 433,166	118 203
1934	6,211,133	169 850
1935	5,947 754	167 135
1936	6,507 413	192 937
1937	7,463 111	207,135
1938	7 587,523	175 493
1939	8,740 576	184 975
1940	8,860 034	183,518
1941	11,302 376	(A) 276 454
1942	16,811 959	(A) 329,154
1943	13,760 354	242,577
1944	15 648 426	243 836
1945	25 086 866	315,930
1946	59 543 323	767,569
1947	102 723,690	1 224,810
1948 (Est)	112,622,000	1,378,600

(A) Estimated

DOMESTIC

	Gasoline (Gallons)	Oil (Gallons)
1932	19 766 173	588,238
1933	21,893,630	806 208
1934	18 925,141	668,906
1935	27 312,855	712 640
1936	30,646 408	680,335
1937	33,961,273	637,435
1938	37,722,669	654 377
1939	47,196,559	736 221
1940	65,674 895	1,104,289
1941	81,657 020	1,282 064
1942	68 908 271	1,008 371
1943	65 025,412	894 262
1944	89 513,646	1,266,741
1945	134 824,120	1,709,566
1946	236 388 751	2,876,250
1947	294,196,130	3,733,728
1948 (Est)	322,340,119	4,117,646

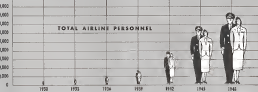
PERSONNEL

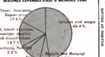
DOMESTIC

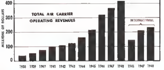
Year	Pilots & Copilots	Pursers Stewards Stewdsses.*	Other Flight Personnel	Meteorol-ogists & Dispatchers	Mechanics	Other Hanger and Field Personnel	Ticket Agents and Reservationists Office Employees	All Others	Total
1932	640	0	0	0	1,641	939	800	0	4,020
1933	680	0	0	0	1,810	1,089	790	0	4,369
1934	667	0	0	0	1,650	923	961	0	4,201
1935	874	213	0	0	2,016	470	2,372	0	5,945
1936	1,055	333	0	0	2,164	546	2,981	0	7,079
1937	1,064	339	0	0	2,228	658	3,297	0	7,586
1938	1,135	358	0	186	2,436	712	3,715	472	9,008
1939	1,412	536	0	181	2,822	877	4,583	228	10,639
1940	1,934	914	18	193	4054	1,880	5,855	1,131	15,984
1941	2,217	1,028	19	220	4,423	2,224	7,807	1,285	19,223
1942	2,194	753	112	1,581	9,348	2,969	7,717	2,236	26,910
1943	2,125	845	8	1,685	8,271	3,356	10,973	2,391	29,654
1944	2,879	1,322	11	1,870	7,136	3,509	12,201	2,270	31,198
1945	4,967	2,075	108	2,613	10,844	7,012	19,241	3,453	50,313
1946	5,712	3,342	98	3,577	16,107	10,307	24,626	5,413	69,182
1947	5,030	3,061	181	2,619	15,372	8,407	21,980	2,348	58,998
1948 (Est)	4,710	3,285	752	2,857	14,894	9,950	17,378	7,453	61,279

INTERNATIONAL

Year	Pilots & Copilots	Pursers, Stewards, Stewdsses	Other Flight Personnel	Meteor-ologists & Dispatchers	Mechanics	Other Hanger & Field Employees	Ticket Agents and Reservationists Office Employees	All Others	Total
1932	77	0	0	0	435	576	502	0	1,590
1933	77	0	0	0	517	750	584	0	1,926
1934	92	0	0	0	558	928	698	0	2,274
1935	121	0	0	0	602	1,048	636	0	2,407
1936	186	57	0	0	710	1,221	742	0	2,916
1937	291	81	0	0	1,050	1,698	880	0	4,000
1938	278	93	0	0	977	1,923	995	0	4,266
1939	287	103	7	0	1,181	2,138	1,559	0	5,275
1940	340	122	15	0	1,359	2,397	1,834	0	6,067
1941	447	182	30	0	1,966	2,707	1,903	0	7,235
1942	452	378	129	29	3,534	4,415	3,366	0	12,803
1943	207	147	322	511	2,140	1,835	1,859	2,604	9,625
1944	466	194	266	631	2 827	2,239	3,033	1,753	11,409
1945	930	411	938	864	5,099	2,435	4,663	2,628	17,968
1946	1,508	1,079	1,405	1,454	7,269	2,463	6,961	5,233	27,372
1947	1,603	1,016	1,152	1,211	5,774	3,201	10,679	1,518	26,154
1948 (Est)	1,536	1,199	1,036	886	4,619	3,039	3,610	5,592	21,517







AIR CARRIER OPERATING REVENUES

Year	Passenger	% of Total	Mail	% of Total	Express & Freight	% of Total	Others	% of Total	Total
DOMESTIC:									
*1938	$24,860,594	57 9	$15,837,951	37 0	$ 1,278,164	3 0	$ 907,974	2 1	$ 42,920,683
1939	34,843,711	62 3	18 482,476	33 0	1 619,132	2 9	1,002,447	1.8	55,947,766
1940	53,308,172	69 4	20,090 123	26 1	2,077,7 26	2.7	1,387,622	1 8	76,863,643
1941	69,791,338	71 7	22,696,351	23 3	2,919,003	3 0	1,904,442	2 0	97,311,134
1942	74,819,050	69 1	23,470 088	21 7	6,977,943	6 4	2,981,749	2 8	108,248,830
1943	87,481,456	71 0	24,212,580	19 7	8,381,539	6 8	3,029,390	2.5	123,104,965
1944	116,440,690	72 3	33,317,366	20 7	8,306,288	5 2	2,863,848	1 8	160,928,192
1945	166,519,922	77 5	33,693,467	15 7	10,835 138	5.0	3 694,563	1 8	214,743,090
1946	275,593,712	87 2	20,981,542	6 6	13,620,295	4 3	6,037,244	1 9	316,232,793
1947	308,575,954	84.6	29,444,746	8 1	19,377,860	5 3	7,433,388	2 0	364,831,948
1948 (Est)	336,662,000	80 8	48,385,000	11 6	24,118,000	5 8	7,310,000	1 8	416,475,000
INTERNATIONAL:									
1946	$91,416,814	62 4	$35,443,612 (A)	24 1	$11,318,501	7 8	$ 8,457,609	3.7	$146,636,536
1947	140,652,112	67 3	40,824 878 (A)	19 5	17,526,275	8 4	10,016,262	4 8	209,009 530
1948 (Est)	147,030,000	63 1	54,724,400 (A)	23 5	20,644 276	8 9	10,563,520	4 5	232,962,190

* Colonial not included in 1938

ASSETS & LIABILITIES—DOMESTIC TRUNK AIRLINES—SELECTED YEARS

	1941	1944	1945	1946	1947	1948*
Current assets	$48,378,162	$139,685,990	$148,083,458	$152,381,834	$132,484,511	$143,245,000
Flight Equipment (net)	25,816,357	13,895,946	41,162,511	117,884,329	173,885,000	192,217,000
Other Op property	5,832,000	11,531,413	24,085,302	47,408,722	70,741,538	73,696,000
Non Operating property	903,134	1,292,305	642,872	2,832,701	2,789,790	2,645,000
Other Assets	5,726,255	21,313,663	34,729,196	66,592,900	54,676,717	43,820,000
TOTAL ASSETS	$86,655,908	$187,719,317	$248,703 339	$387,100,486	$434,577,556	$455,623,000
Current liabilities	21,931 456	53,431 795	73,412,182	105 659,559	81,829,236	89,106,000
Long term debt	1,561,727	147,126	24,421,800	90,097,738	161,170,650	172,393,000
Capital stock	32,043,968	48,751,442	52,245,472	92,896,915	112,621 702	121,311,000
Capital surplus	22,402,837	27,631,474	32,919,664	46,989,868	41,929,868	60,744,000
Earned surplus	5,823,247	43,833,022	58,614,766	41,018,688	10,302,299	—4,056,000
Operating reserves	1,006 165	687,501	505,977	1,139,235	1,591,145	2,125,000
Other liabilities	1,886,508	13,236 957	6,583,478	9,298,483	25,114,656	14,000,000
Net worth and liabilities	86,655 908	187,719,317	248 703,339	387,100,486	434,577,556	455,623,000
Net worth	60,299 650	126,767,395	143,779,903	180,905,570	178,871,869	177,999,000

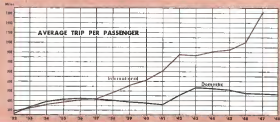
*—As of September 30. All other years are as of December 31.

DOMESTIC AIRLINE REVENUE PASSENGER MILES BY MONTHS

(in millions)

	1941(A)	1942(A)	1943(A)	1944	1945	1946	1947	1948
January	69,048	104,574	97,508	135,477	200,819	331,714	380,757	401,902
February	75,168	95,094	107,276	119,217	182,869	331,963	372,276	357,204
March	85,899	128,701	120,660	136,125	240,475	406,404	493,864	440,320
April	103,512	148,607	129,447	148,984	246,418	461,703	526,188	484,249
May	122,810	137,757	130,130	174,410	277,213	512,625	563,771	540,573
June	130,760	103,913	137,832	186,798	295,402	562,722	546,685	589,946
July	136,726	110,864	147,125	204,357	320,154	569,875	543,541	562,381
August	146,813	121,554	154,026	219,661	332,014	624,479	611,838	571,175
September	147,573	120,690	151,562	217,256	315,895	611,962	609,756	554,115
October	141,306	124,054	153,315	230,403	339,687	557,486	578,889	542,976
November	106,618	108,779	142,507	208,483	314,704	468,875	435,083	459,490
December	103,352	93,456	134,731	196,986	296,805	508,148	441,231	
TOTAL	1,369,585	1,398,043	1,606,119	2,178,207	3,362,455	5,947,956	6,103,879	5,505,331

(A) Figures do not include all airlines



AVERAGE PASSENGER FARES AND TRIPS

	Average Passenger Fare Per Mile		Average Trip Per Passenger		Ratio of Domestic Air Pass Miles to Pullman Pass Miles
	Domestic	International	Domestic	International	
1932	6.1¢	*	268	289	1.9%
1933	6.1¢	*	348	315	2.8
1934	5.9¢	*	399	351	2.8
1935	5.7¢	*	415	381	4.4
1936	5.7¢	*	421	414	5.3
1937	5.6¢	*	418	416	5.2
1938	5.2¢	*	401	487	6.8
1939	5.1¢	*	394	557	8.9
1940	5.1¢	*	375	614	14.1
1941	5.0¢	*	360	713	15.0
1942	5.3¢	*	452	880	7.9
1943	5.3¢	7.9¢	541	874	6.5
1944	5.4¢	7.9¢	538	910	7.8
1945	4.5¢	8.7¢	511	942	12.5
1946	4.5¢	8.3¢	487	1,057	29.4
1947 (Est.)	5.0¢	7.6¢	474	1,332	48.5
1948 (Est.)	5.6¢	*	462	*	50.0

* Not available

PASSENGERS CARRIED

(Monthly Average)

	Domestic	International
1932	39,670	5,960
1933	41,851	6,199
1934	39,622	8,067
1935	63,568	9,275
1936	86,837	7,310
1937	94,195	9,360
1938	113,809	9,105 (A)
1939	157,983	11,341
1940	253,218	14,182
1941	345,146	19,650
1942	296,614	23,017
1943	290,350	24,407
1944	396,776	29,722
1945	633,821	41,125
1946	1,142,113	88,845
1947	1,074,183 (A)	113,284 (A)
1948	1,083,500 (A)	108,350 (A)

(A) Revenue passengers only.

PASSENGER FATALITIES

Scheduled Airline Passenger Fatalities

	Number of Domestic Fatalities	Fatalities Per 100 Million Passenger Miles	Number of International Fatalities	Fatalities Per 100 Million Passenger Miles	Total Number of Fatalities
1932	19	14.96	6	28.9	25
1933	8	4.61	0	0	8
1934	17	9.05	4	10.9	21
1935	15	4.78	0	0	15
1936	44	10.10	2	4.8	46
1937	40	8.39	11	13.9	51
1938	25	4.48	7	13.2	32
1939	9	1.20	10	12.8	19
1940	35	3.05	0	0	35
1941	35	2.35	2	1.2	37
1942	55	3.71	0	0	55
1943	22	1.34	10	3.9	32
1944	48	2.12	17	5.3	65
1945	76	2.23	17	3.7	93
1946	75	1.24	40	3.6	115
1947	199	3.21	20	1.08	219
1948 (Est.)	83	1.41	20	1.06	103

COMPARATIVE TRANSPORTATION SAFETY RECORD

Passenger Fatalities and Rate of Passenger Fatalities per 100,000,000 passenger miles

	1941	1942	1943	1944	1945	1946	1947	1948
Domestic Scheduled Air Transport Planes	35	55	22	48	76	75	199	85
Rate	2.32	3.66	1.32	2.09	2.14	1.20	3.21	1.41(est.)
Buses	*	*	*	*	120	140	140	*
Rate	.24	.23	.22	.22	.17	.19	.21	*
Railroad passenger trains	39	110	262	249	145	115	75	*
Rate	.14	.17	.31	.26	.16	.18	.16	*
Passenger Automobiles and taxicabs	*	*	*	*	12,900	15,400	15,300	*
Rate	4.0	4.0	2.7	2.9	2.9	2.5	2.3	*

* [illegible] available

AIRPORTS BY CLASSES • (AS OF DECEMBER 31)

Length of Runways	1941	1942	1943	1944	1945	1946	1947(A)	1948(A)
1800-2700 ft. Class I (and under)	1,523	1,238	910	1,215	1,620	2,491	3,525	4,006
2500-3500 ft. Class II	702	905	774	936	1,091	758	972	845
3500-4500 ft Class III	187	367	430	464	484	485	471	422
4500-5700 ft Class IV	72*	299*	366	473	488	443	361	314
5700-6700 ft. Class V	.....	.....	289	339	343	313	131	100
6700-7700 ft. Class VI	.....	.....	.....	.....	.....	.....	75	52
TOTAL	2,484	2,809	2,769	3,427	4,026	4,490	5,258	6016

*—Class IV and over (A) Civil airports only

USE OF AIRPORTS

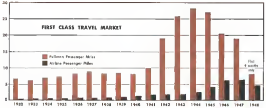
Number of Flight Operations

Fiscal Year	Military	Civil	Air Carrier	Air Carrier Percentage
1944	8,390,000	3,594,000	916,000	7.1
1945	6,460,567	3,343,303	1,409,102	12.6
1946	2,457,878	5,091,671	2,042,049	21.3
1947	1,402,909	11,262,191	2,630,472	17.2
1948	1,871,413	13,820,525	3,052,781	16.3

AIRLINE STOPS

Certificated as of December 31, 1948

Total domestic	773
Stops in use (208 trunk, 168 feeder, 148 combination trunk and feeder)	524
Stops not in use (64 trunk, 192 feeder; 11 combination trunk and feeder)	249



DOMESTIC AIR CARRIER OPERATING EXPENSES

	Aircraft Operating Expenses	% of Total	Ground and Indirect	% of Total	Total Operating Expense
1938	$ 24,987,651	57.0	$ 18,876,986	43.0	$ 43,864,637
1939	26,294,372	51.6	24,692,097	48.4	51,391,560
1940	35,178,395	50.1	35,028,420	49.9	70,896,615
1941	44,932,205	50.0	44,986,928	50.0	89,919,134
1942	36,392,090	43.1	47,974,400	56.9	84,366,489
1943	34,613,411	36.2	60,949,609	63.8	95,563,020
1944	45,150,125	36.3	79,371,967	63.7	124,522,092
1945	69,222,625	38.3	111,403,704	61.7	180,626,329
1946	129,249,600	40.1	192,969,583	59.9	322,219,183
1947	169,159,986	43.8	217,027,687	56.2	386,187,673
1948 (Est.)	192,554,700	45.2	233,061,000	54.8	425,615,700

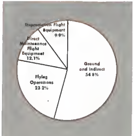
	Flying Operations	% of Total	Direct Maintenance Flight Equip	% of Total	Deprecia-tion Flight Equip	% of Total
1938	$ 14,737,164	33.6	$ 5,345,247	12.2	$ 4,905,240	11.2
1939	15,809,055	31.0	5,651,202	11.1	4,834,126	9.5
1940	22,092,628	31.5	7,495,998	10.7	5,589,769	7.9
1941	27,391,837	30.5	9,789,797	10.9	7,750,571	8.6
1942	21,865,924	25.9	8,664,437	10.3	5,861,730	6.9
1943	20,739,121	21.7	9,132,260	9.5	4,742,030	5.0
1944	28,238,316	22.7	11,892,963	9.6	5,018,845	4.0
1945	43,421,033	24.0	16,392,654	9.1	9,408,938	5.2
1946	70,409,644	21.8	33,272,916	10.3	25,567,040	7.9
1947	88,835,181	23.0	42,902,710	11.1	37,422,095	9.7
1948 (Est.)	98,729,500	23.2	51,398,000	12.1	42,427,200	9.9

DOMESTIC AIRLINE PERCENTAGE OF FIRST CLASS TRAVEL MARKET

	Pullman Passenger Miles	Airline Passenger Miles	Total	Airline Percentage of Total
1932	6,758,000	127,433	6,885,433	1.85
1933	6,141,987	174,820	6,316,807	2.77
1934	6,891,002	189,806	7,080,808	2.66
1935	7,146,270	316,336	7,462,606	4.24
1936	8,354,840	438,989	8,793,829	4.99
1937	9,170,428	481,116	9,651,544	4.98
1938	8,269,882	560,660	8,830,542	6.35
1939	8,485,399	755,118	9,240,517	8.17
1940	8,213,879	1,157,900	9,371,779	12.36
1941	10,070,407	1,506,303	11,576,710	13.01
1942	19,071,589	1,501,279	20,572,868	7.30
1943	25,891,466	1,670,935	27,562,401	6.06
1944	28,267,091	2,211,905	30,478,996	7.26
1945	27,275,789	3,408,290	30,684,078	11.11
1946	20,672,367	6,068,315	26,740,682	22.69
1947	19,307,690	6,307,690	19,307,690	32.67
1948 (A)	8,434,582	4,512,322	12,946,904	34.85

(A) First 9 months only.

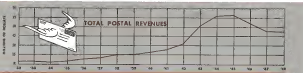
AIRCRAFT OPERATING EXPENSE



POST OFFICE DEPARTMENT AIR MAIL REVENUES

Fiscal Year Ending June 30	Air Mail Revenues		Cost of Air Mail** Service to P O Dept		Net Revenue to P O Dept
	Domestic	International	Domestic	International	
1939	$ 16,326,358	$ 3,925,513	$ 25,061,293	$ 9,814,972	—$14,624,394
1940	19,122,906	5,914 405	28,039,250	14,119,547	—17,121,486
1941	23,920,465	9 309,793	30,881,839	17,333,961	—14,985,542
1942	33,417,367	12,015,864	36,508,587	15,736,672	— 6,812,028
1943	62,818,568*	31,646,182	44,463,208	23,068,539	26,933,003
1944	79,412 510	51,276,499	49,881,593	30 400 406	50,407,010
1945	81,237,389	110,675,066	49,937,041	57,652 079	84,323,335
1946	68,427,924	58,081,237	49,011,932	46,406,545	31,090,684
1947	54,356,782	21,772,578	73,341,207	33,130,428	—30,342,275
1948	53,586,950	23,815,519	80,662,381	51,571,220	—54,831,132
Total	$492,627,219	$328,432,656	$467,788,331	$299,234,369	$54,037,175

*Estimated
**Includes direct costs allocated by P.O. Dept to air mail service.



AIR MAIL POSTAL REVENUES AND PAYMENTS TO AIRLINE CARRIERS

Fiscal Year Ending June 30	DOMESTIC		INTERNATIONAL	
	Postal Revenues	Payments to Airlines	Postal Revenues	Payments to Airlines
1932	$ 6,016,000	$ 19,938,123	$ 1,075,352	$ 6,962,984
1933	6,116,000	19,400,265	942,584	6,984,189
1934	5,738,000	11,737 529	1,290,804	6,942,375
1935	6,590,000	8,837,650	1,602,890	6,829,312
1936	9,702,700	12,179,266	1,950,010	6 619,760
1937	12,439,600	13,165,179	2,148,170	7,878,152
1938	15,301,200	14,739,929	3,757,499	8,582,275
1939	16,326,400	17,020,169	3,925,512	9,327,445
1940	19,122,900	19,425,732	5,914,405	12,431,965
1941	23,920,500	20,687,220	9,309,793	15,628,695
1942	33,417,400	23,473,170	12,015,864	14,298,159
1943	62,818,600	23,308,477	31,646,182	5,563,283
1944	79,412,510	28,401,373 (A)	51,276,499	3,231,371
1945	81,237 390	35,536,292 (A)	110,675,066	6,021,671 (A)
1946	68,427,924	26,787,756 (A)	58,081,237	10,024,515 (A)
1947	54,356,782	21,736,346 (A)	21,772,578	27,262,000 (A)
1948 (Est)	53,586,950	47,000,000 (A)	23,815,519	40,500,000 (A)

Does not include airmail to and from armed forces overseas
*Not available. (A) Subject to final adjustment

AIR MAIL, MILES AND PAYMENTS

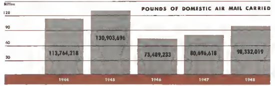
Fiscal Year Ending June 30	DOMESTIC						INTERNATIONAL	
	Payments Per Plane Mile	Load Per Mile Flown, Pounds	Pound Miles Per Route Mile	Revenue Miles Flown	Route Miles Air Mail Service	Thousands of Pound Miles Performed	Plane Miles Flown	Payments Per Plane Mile
1932	$ 619	*	*	32,202 170	26,745	6,275,935	3,778,729	$1.84
1933	540	*	*	35,909,811	27,679	4,834,540	3,775,455	1.84
1934	403	*	*	29,111,474	28,820	4,513,880	3,767,102	1 84
1935	284	218	235,095	31,148,693	28,884	6,790,486	3,682,621	1.85
1936	315	253	334,675	38,695,963	29,198	9,771,841	3,754,537	1 76
1937	.329	319	429,834	39,958,771	29,622	12,732,530	4,448,608	1.77
1938	319	306	420,067	46,166,162	33,655	14,137,360	4,994,558	1.72
1939	,326	303	426 608	52,141,758	37,080	15,818,617	5,357,405	1.74
1940	.328	315	492,090	59,236,453	37,943	18,671,367	5,907,124	2.10
1941	.273	295	513,579	75,689,839	43,411	22,294,962	8,238,349	1.90
1942	.263	352	703,768	89,307,567	44,623	31,404 257	8,858,294	1.61
1943	.262	634	1,251,401	88,963,296	45,304	56,492,340	15,633,483	.36
1944	.264	786	1,734,022	107,650,804	49,482	84 579,690	19,485789	.17
1945	.213	723	2,162,025	166,576,371	56,849	122,908,961	24,275,760	.25
1946	.121	395	1,772,013	221,724,860 (A)	57,377	101,672,777 (A)	40,659,256	.25
1947	.069	203	658,592	314,505,965 (A)	102,454	67,475,414 (A)	61,213,887 (A)	25
1948	.143 (A)	*	520,562	321,661,655 (A)	130,093	67,716,848 (A)	91,439,534	44

*Not available
(A) Subject to adjustment

POUNDS OF AIR MAIL, DOMESTIC AIRLINES, 1944-1948

	1944	1945	1946	1947	1948
January	8,456,674	11,049,607	7,464,318	6,277,245	6,946,678
February	8,097,692	10,224,785	6,166,800	6,199,727	6,683,024
March	8,870,568	12,136,830	6,490,309	6,511,265	7,751,926
April	8,253,891	11,021,140	5,934,201	6,646,407	7,220,696
May	8,908,702	11,806,977	6,009,768	6,798,560	7,707,009
June	9,120,304	11,685,451	5,464,615	6,491,651	7,426,041
July	9,249,413	11,396,335	5,357,859	6,432,484	7,369,330
August	10,213,289	11,600,028	5,316,405	6,301,397	7,560,556
September	9,979,840	11,902,348	4,886,066 (A)	6,272,634	8,229,105 (B)
October	10,594,319	10,444 634	6,098,131	7,070,890	8,904,571 (B)
November	10,551,525	8,844,591	6,196,036	6,577,665	8,970,567 (B)
December	11,468,001	8,790,970	8,104,725	9,116,693	13,562,518 (B)

(A) Sept 1946—last month of 8¢ rate
(B) Includes air parcel post.



AIRCRAFT UTILIZATION DOMESTIC AIRLINES

	No. of Motors	1939		1940		1941		1942		1943		1944		1945		1946 1/		1947 1/		1949 1/	
		No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day	No. Planes	Av. Mi. Per Day
Beechcraft	2	.....	.....	.....	.....	.....	.....	1.0	325	2.0	437	1.2	323	0.8	66	0.4	502	5.3	564	6.5	219
Boeing																					
247 D	2	39.1	579	34.9	468	29.3	458	11.3	521	1.0	248	.....	.....			1.0	607	3.8	661	0.8	800
SA 307B	4	.....	.....	3.1	1,354	5.0	1,596	0.8	1,230	.....	.....	.....	.....	3.6	2,094	5.0	1,695	5.0	1,315	5.0	1,326
Consolidated-Vultee Convair	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.3	907
Douglas																					
DC-2	2	45.2	785	42.2	715	16.9	650	5.6	668	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
DC-3	2	86.2	1,125	145.2	1,198	214.6	1,174	179.6	1,424	161.8	1,671	205.8	1,814	314.4	1,756	426.6	1,638	438.2	1,275	429.2	1,194
DST	2	30.5	1,512	38.6	1,569	44.8	1,526	16.5	1,584	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
DC-4	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	85.8	1,758	148.3	1,511	155.0	1,317
DC-6	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	21.1	1,388	46.3	1,825
Lockheed																					
Electra	2	41.8	748	33.8	583	21.5	527	6.6	559	.....	.....	.....	.....	1.3	727	3.0	587	.....	.....	.....	.....
Lodestar	2	.....	.....	4.4	661	13.7	829	10.9	1,152	11.5	1,392	14.3	1,719	17.7	1,545	16.7	1,265	11.4	1,056	12.0	258
Constel.	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.6	1,190	21.4	1,659	30.9	1,828
Sikorsky	2	5.8	195	6.0	203	5.8	281	4.0	151	3.0	210	2.8	240	2.0	184	0.1	100	.....	.....	.....	.....
Stinson																					
Single Mot.	1	.....	.....	.....	.....	8.8	262	7.5	326	9.3	379	10.6	377	10.9	404	11.0	445	7.6	412	7.0	439
Tri-motored	3	3.2	133	2.0	109	.....	.....	1.8	0	4.4	151	4.0	148	4.0	61	.....	.....	.....	.....	.....	.....
Waco	1	.....	.....	.....	.....	.....	.....	0.4	228	0.3	337	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Martin 202	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.0	572	15.4	843

1/Includes feeder lines and territorial lines. 1949 data are for 9 months only

ROUTE MILEAGE AS OF DECEMBER 31, 1948

DOMESTIC	
All American	1,538
American	19,954
Braniff	4,831
Capital	5,720
Catalina	47
Chicago & Southern	6,162
Colonial	1,383
Continental	2,923
Delta	7,371
Eastern	12,461
Inland	1,910
Mid Continent	4,474
National	2,694
Northeast	2,182
Northwest	11,403
Pan American	34
TWA	11,580
United	15,771
Western	3,103
Hawaiian	356
TOTAL	115,897

INTERNATIONAL	
American Overseas	9,134
Braniff	7,600
Caribbean Atlantic	388
Chicago & Southern	3,697
Colonial	2,030
Eastern	917
National	445
Northwest	15,222
Pan American	98 689
Panagra	10,666
TWA	21,307
UMCA	382
Western	1,640
TOTAL	172,117

OVERSEAS	
Eastern	1,040
United	2,400
Northwest	2,736
TOTAL	6,176

FEEDER	
Arizona Airways	1,020
Central	1,308
Challenger	1,613
Empire	710
Florida	471
Iowa	1,251
Island Air Ferries	227
Los Angeles Airways	320
Monarch	1,650
Parks	1,647
Piedmont	1,905
Pioneer	2,186
Robinson Aviation	539
Southern	1,374
Southwest	1,216
Trans Texas	2,028
Turner (Roscoe)	655
West Coast	885
Wiggins	643
Wisconsin Central	1,485
TOTAL	23,133

Feeders are classed with domestic, giving latter total as 139 030 This is of course, duplicated route mileage International and overseas total is 179,293

THE SPEED OF AIR TRANSPORT—1948

Selected examples of routine elapsed scheduled flight time between important cities

New York and Boston	1 hr
Washington	1 hr 5 min
Miami	4 hrs.
New Orleans	4 hrs
Chicago	3 hrs 20 min
Los Angeles	11 hrs 10 min
San Francisco	10 hrs 55 min
Seattle	14 hrs 45 min
London	13 hrs.
Paris	13 hrs. 40 min
Anchorage	18 hrs 55 min
Lima	24 hrs. 5 min
Rio de Janeiro	32 hrs.
Buenos Aires	40 hrs 45 min
Tokyo	39 hrs
San Francisco and Honolulu	12 hrs
Los Angeles	2 hrs 10 min
Chicago	9 hrs
Washington	10 hrs 50 min
Chicago & Minneapolis St Paul	1 hr 45 min
Dallas Ft Worth	3 hrs 20 min
Mexico City	9 hrs 35 min
Miami	4 hrs
New Orleans	5 hrs 20 min
Washington and Los Angeles	11 hrs. 15 min.
Bermuda	4 hrs
Atlanta	2 hrs 49 min.
Rome	16 hrs
Havana	5 hrs. 40 min.

LOCAL SERVICE AIR LINES

	1947	1949 (est.)
Number of Planes	50	73
Total Passengers Carried	246 747	426 900
Total Passenger Miles	53 452,034	91,296 000
Route Miles	20 999	23 133
Revenue Miles	10,206,749	19 304,000
Air Mail Ton Miles	176 790	341 000
Express Ton Miles	131,925	194 979
Freight Ton Miles	93,772	263 000
Passenger Load Factor	31 0	29 3

ARIZONA AIRWAYS
† ALL AMERICAN AIRWAYS
* CENTRAL AIRLINES
†* CHALLENGER AIRLINES
CHESAPEAKE AIRWAYS
†* EMPIRE AIR LINES
†* FLORIDA AIRWAYS
ISLAND AIR FERRIES
* IOWA AIRPLANE CO
LOS ANGELES AIRWAYS
†* MONARCH AIR LINES
* PARKS AIR TRANSPORT
†* PIEDMONT AVIATION
†* PIONEER AIR LINES
† ROBINSON AIRLINES
ROSCOE TURNER AERONAUTICAL CORP
* SOUTHERN AIRWAYS
†* SOUTHWEST AIRWAYS
* TRANS TEXAS AIRWAYS
WEST COAST AIRLINES
* WIGGINS AIRWAYS
†* WISCONSIN CENTRAL AIRLINES
YELLOW CAB CO (CLEVELAND)

† MEMBER OF ATA * MEMBER OF COUNCIL

TEAM-WORK FOR PROGRESS is the objective of the Air Transport Association of America Its activities range from development of safety to study of legislation, from economic surveys to analysis of operating costs, from development of better air terminals to the full promotion of air transport by the public Through ATA the experience and attainments of individual airlines are quickly combined to the advantage of all Through ATA the efforts of eight government agencies and four private agencies are welded into unified action for the benefit of the travelling public and the national welfare

The ATA is the cooperative industry organization founded in 1936 and composed of the United States Flag Airlines certificated by the Civil Aeronautics Board for scheduled service over regularly established routes The operations of the member carriers are domestic, territorial, and international in scope Their field covers the transportation of passengers, property and mail by aircraft The Association concluded the year 1948 with 31 members operating in and from the United States, together with two associate members in Canada and two associates in Latin America Nine members are local service airlines which are duly certificated regional carriers

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Milton W Arnold	*Vice President, Operations & Engineering*
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Stuart G Tipton	*General Counsel*
Joseph Hintersehr	*Treasurer*

AVIATION WEEK is honored to present the Air Transport Association's 10th Annual Edition of "Little Known Facts" about the airlines. These vital Facts and Figures depict the development and progress of air transport throughout the years and have been assembled by ATA from revised CAB data on the air carrier industry.

AVIATION WEEK

MEMBERS

Alaska Airlines	501 Fifth Ave , New York N Y
All American Airways, Inc	National Airport Washington 1, D C
American Airlines System	100 East 42nd St , New York 17 N Y
American Overseas Airlines	100 East 42nd St New York 17, N Y
Braniff International Airways, Inc.	Love Field Dallas 9, Texas
*Canadian Pacific Air Lines Ltd	Dominion Square Bldg , Montreal 2 Canada
Capital Airlines, Inc	Washington National Airport, Washington 1, D C
*Caribbean Atlantic Airlines, Inc	P O Box 3214 San Juan, Puerto Rico
†Challenger Airlines, Inc.	Stapleton Airport Denver Colorado
Chicago & Southern Air Lines, Inc	Memphis Municipal Airport Memphis 2 Tenn
Colonial Airlines, Inc	630 Fifth Ave , New York 20 N Y
Continental Air Lines, Inc	Municipal Airport, Denver Colorado
Delta Air Lines, Inc.	Municipal Airport Atlanta, Ga
Eastern Air Lines, Inc	10 Rockefeller Plaza, New York 20 N Y
†Empire Air Lines, Inc	Box 268 Boise Idaho
*Florida Airways, Inc	Orlando Florida
Hawaiian Airlines, Ltd	Inter Island Bldg Honolulu 1, T H
Inland Air Lines, Inc	6060 Avion Drive Los Angeles 45 Calif
Mid-Continent Airlines, Inc	102 East 9th St Kansas City, Mo
†Monarch Air Lines, Inc	Stapleton Airfield Denver 7 Colorado
National Airlines, Inc	2240 N W 27th Ave Miami Fla
Northeast Airlines, Inc	238 Prescott St East Boston 28 Mass
Northwest Airlines, Inc	1885 University Ave St Paul 4, Minn
Pacific Northern Airlines	505—4th Ave Anchorage, Alaska
*Pan American-Grace Airways, Inc	Chrysler Bldg , New York 17 N Y
Pan American World Airways, Inc.	Chrysler Bldg New York 17 N Y
†Piedmont Aviation Inc	Smith Reynolds Airport Winston-Salem 1, N C.
†Pioneer Air Lines, Inc	Municipal Airport Houston 12, Texas
†Robinson Airlines Corp	Seneca Building Ithaca, N Y
†Southwest Airways Co	P O Box 268 South San Francisco, Calif
*Trans-Canada Air Lines	360 McGill St , Montreal Quebec Canada
Trans World Airline	101 West 11th St Kansas City 6 Mo
United Air Lines, Inc.	5959 S Cicero Ave , Chicago 38 Ill
Western Air Lines Inc	6060 Avion Drive Los Angeles 45 Calif
†Wisconsin Central Airlines, Inc.	Municipal Airport Madison Wisconsin

* Associate members

† Local Service Airlines

Behind the Scenes *at Hamilton Standard Propellers*

Every time a bulging C-54 sets down a nine-and-a-half ton load of flour or macaroni at Tempelhof on the Berlin Airlift, four Hamilton Standard propellers have just finished revolving a hundred thousand times each. In an average day's operation of the Airlift, that means more than half a billion propeller revolutions.

What's so exciting about that?

The exciting thing is that there's nothing exciting about it. What we mean is that the propellers don't break — they just keep rolling along. Yet according to all the laws of the Medes and the Persians, they *should* break — because of fatigue.

Fatigue, as you probably know, means progressive failure due to repeated stress. You may not know that fatigue is responsible for most of the fractures that occur when metal is stressed.

And in a propeller, loads are high, materials are light, and vibration is always present. So, every time a propeller turns over, vibration is insidiously and relentlessly jiggling away, trying to allow old man fatigue to cause a failure.

Why doesn't he succeed?

Because we have been just as relentlessly tracking him down in our laboratories. We've spied on him with microscopes and cameras, we've measured him by electricity, we've X-rayed him, we've studied his behavior under conditions of bitter cold and blazing heat.

Here in the Hamilton Standard laboratories, a staff of some 20 specialists has devoted all its time for many years to the study of fatigue and its related problems. In collaboration with designers, metallurgists, production experts and others they have found the answers to many of these problems. They have played an important part in reducing failures to the vanishing point

Our continuing study of fatigue, of course, represents only one phase of the complex task of designing, developing and producing Hamilton Standard propellers. But already it has contributed heavily to the dependability of modern aircraft that makes possible such magnificent performances as the Berlin Airlift. And every day it is helping us to design safer, lighter, more efficient propellers to meet the requirements of the future.

IN TESTING A PROPELLER BLADE, HOW MANY VIBRATIONS A DAY ARE IMPOSED UPON IT?

- ☐ 100,000?
- ☐ 1,000,000?
- ☐ 10,000,000?

Because vibration is the major potential cause of blade failure, each new blade design is subjected to full scale vibration testing. After being rigged with strain gauges to measure stresses at as many as 50 different places, the blade is connected to a vibration motor which literally shakes the daylights out of it — often at a rate as high as 10,000,000 vibrations every 24 hours. In a week we can subject a blade to as many vibrations as might occur in months of normal airline service. This process continues until a fracture finally develops — sometimes after more than a billion vibrations. When we are finished, we have broken the test blade, but we have learned enough about its strength characteristics to make installations that will not break in actual service.

WHICH HAS THE MOST EFFECT UPON THE FATIGUE STRENGTH OF A PROPELLER?

- ☐ Heat?
- ☐ Cold?
- ☐ Moisture?

An interesting fact is that neither heat nor cold has much effect upon a propeller's resistance to fatigue, even though operating conditions may vary from 50° below zero Fahrenheit to 150° above. On the other hand moisture — particularly the salt spray encountered by seaplanes and flying boats — can reduce the fatigue strength of a blade unless it is adequately protected against corrosion.

Heat, cold and moisture have to do only with the environment in which the propeller operates. But in addition to such factors, there are many others concerned with materials, design, fabrication and stressing. *All* of them must be taken into account in producing dependable propellers that will successfully resist fatigue failure.

WHICH OF THESE THREE THINGS DO WE USE IN OUR FATIGUE TEST LABORATORY?

- ☐ Shotgun?
- ☐ Railroad Ballast?
- ☐ Sea Water?

Believe it or not, we use all three. A 12 gauge shotgun, loaded with special quartz pellets, is fired across a propeller blade to cut and scratch its surface. A chunk of railroad ballast, half as big as your fist, is banged against a blade to dent and bruise it. And, sea water is dripped on other vibrating samples to corrode them. From these and other studies we determine the amount of punishment that propeller blades can take from such things as sand, stones and salt spray in actual day to day service.

HOW MANY RADIO STATIONS ARE THERE IN HARTFORD?

- ☐ Four?
- ☐ Five?
- ☐ Six?

According to the official records there are five radio stations in Hartford. However there is, in effect, a sixth — located right here in our fatigue test laboratories. Although it has never broadcast a symphony, a campaign speech, or a weather report, it is fundamentally similar in design and construction to a standard 10,000 watt broadcasting station, and it is hooked up to something like the "loud speaker" in your home. The difference is that the electrical impulses from our broadcasting station, instead of being changed into audible sounds by the "loud speaker" are changed into vibrations and transmitted to the propeller on test. This combination is "on the air" 24 hours a day six days a week, broadcasting a wide variety of vibrations to help us lick old man fatigue.

HAMILTON STANDARD PROPELLERS

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

EAST HARTFORD, CONNECTICUT

HAMILTON STANDARD · EAST HARTFORD CONNECTICUT · UNITED AIRCRAFT CORPORATION · PROPELLERS · WHEREVER MAN FLIES

"Give us the tools . . ."

Now is the time to *FIGHT SOCIALISM* in Washington

Do we want to follow Britain down the economic skids?

We Americans face that question today. For we are being advised by Administration economists in Washington to take the course which destroyed Britain industrially. It is the temporarily easy course of cutting down expenditures for tools in order to have more things to consume right away.

The President's Council of Economic Advisers tells us we are spending too large a part of our national income on new tools and equipment. A larger share, they say, should go for goods and services used directly by consumers.

Before we take that advice, let us look at Britain. When the British once allowed their industrial plants and equipment to run down — they started down a dreary road to industrial stagnation and decay.

British industry once ruled the world. Low production costs enabled it to undersell all competitors. Efficiency gave British workers the highest living standards anywhere.

Now all that Britain has between it and economic disaster is pluck and American aid through the Marshall Plan.

The British people are living poorly — still on rations and in austerity. With practically everyone working, and working longer hours than we do in the United States, they cannot produce enough to pay for the raw materials and food they must import.

How did Britain get in this fix?

The story is complicated. British sacrifices in two wars play a tragic part in it. But another fact also stands out:

Britain began to go downhill even before World War I — when British industries allowed their plants and equipment to grow obsolete.

Once that process started, it grew steadily worse. By 1929 the share of Britain's national income being plowed back into capital investment had shrunk to less than two-thirds of what it had been twenty years earlier. We were putting twice as big a share of our national income into capital goods at this same time.

Skimping on capital equipment — on new plants and new tools — put the skids under industrial Britain.

World War II only speeded up a process already well under way.

British industry today shows the results of its failure to keep up to date. Here are three examples found by Dr. Laci Rostas, Britain's leading authority on measuring workers' productivity.

An American produces *four* times as much pig iron as his British counterpart.

He produces *more than four times* as many tires.

In all industry, on the average, an American produces almost three times as much.

The real reason is the American's better tools. The British are struggling with equipment that is, on the average, forty years old.

Britain once had a big head start in industrial equipment. But she let it slip away. And as it went, Britain's industrial and political leadership slipped with it.

How could British leaders have slept while all this happened?

This, too, is a complicated story. But parts of it stand out clearly:

1. *British business men put in more time perfecting cartels to avoid competition than they did in improving their plants and equipment to meet it.*

2. *British labor leaders concentrated on sharing the work and sharing the wealth — rather than doing the job necessary to have enough wealth to make the sharing worthwhile.*

3. *British governments taxed away the means to buy new equipment. By steadily increasing personal taxes, they undercut the* ability *of individuals to invest in new equipment. Finally, they took away the* incentive *to get new equipment by progressively taxing away any returns on it.*

4. *Farseeing socialists smiled all the while, knowing that as private industry more and more lacked the tools to do a progressive job, they would have their chance to run the country.*

Now, with Britain's fate in their hands, the socialists are trying desperately to stem the nation's economic decline by rebuilding its industrial plants and equipment.

A complete report on our national survey, "Business' Needs for New Plants and Equipment," may be obtained by writing McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y. This is the fifth editorial of a special series on industry's needs for new plants and equipment.

They are making a little headway, but not enough. There are several reasons. One is that Britain must export most of the new equipment she can make. *Another major reason — increasingly important for her future — is that money needed to renovate Britain's run-down industry is taxed away to support welfare programs.* The (London) *Economist* grimly puts it this way:

"The importance of the function of saving has only been discovered now that the means of saving have largely been destroyed."

Our own Federal and State governments, too, have dangerously whittled away incentives. They have more than tripled tax rates on personal and corporation incomes in the last twenty years. Now, the President proposes to do more whittling.

If the United States is not to go Britain's way, we must preserve our incentives to save and to invest in industry.

If the United States is to progress, we must continue to build up our industries.

The President's Economic Advisers say we can slow down. But the McGraw-Hill survey of "Business' Needs for New Plants and Equipment," reported in the previous editorial in this series, produced facts to the contrary. It showed that industry *now* plans — *if it can get the money* — to spend $55 billion in the next five years for new plants and new tools. Moreover, it showed *industry's needs* for new facilities are large.

By cutting down the incentives to save, by giving soothing advice that we do not need to save so much, Washington is pushing us toward Britain's way — the route via industrial stagnation to socialization.

Before we skid too far, we should pull up short and ask ourselves: Do we want to go Britain's way — socialistic way?

There still is time to say, "No."

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

NEW AVIATION PRODUCTS

Simplify Prop Reversing Control

New device designed to afford increased reliability; less weight, lower installation costs are features.

A control unit for reversing propellers which replaces present reversing control switches, has been developed at Consolidated Vultee Aircraft Corp

The simplified device is designed to perform all the operations accomplished by the multiple control relay installation now in use and to eliminate all reversing control relays It is reported to increase reliability of prop reversing systems and afford savings in weight and installation costs

▶**Mechanical Switch**—Although developed for use on Convair Liners, the unit is adaptable to any craft using conventional reverse pitch props

It consists of a mechanically operated switch for reversing and unreversing operations and a coil-operated method for cutting off the reversing mechanism when the prop is in full reverse on Hamilton Standard installations and in positive pitch when unreversing on both Hamilton Standard and Curtiss Electric units. An actuating arm on top of the device is operated by a cam in the throttle system

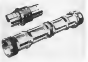
Because the device is mechanically operated voltage required for coil functioning is considerably less than that required by conventional systems This feature is intended to afford increased reversing dependability for a wide range of operating voltage

▶**Tests Underway**—Size of the unit is practically the same as that of control switches now installed All wiring for it is available at existing switch installations Screw-type wire terminals for connection are located in a recessed block at the bottom and covered by a protective plate to prevent entry of foreign matter which might cause faulty operation of the prop

Convair is presently testing a unit which eliminates eight reversing control relays for Hamilton Standard props Nearing the test stage is another unit to eliminate six relays on Curtiss Electric propellers

The control was invented by L J Bordelon, Convair chief flight engineer, who also developed the automatic prop feathering system installed on the Liners

Airite Products Co, Los Angeles, Calif, is licensed to manufacture the control

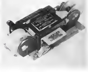


Lightweight Tube Union

Designed to meet need for lighter weight connections in aircraft fuel lines, 1900 Series tube union made by **Roylyn Inc**, 718 W. Wilson Ave, Glendale 3, Calif, is used with flared tube ends and consists of metal seal ring, two sleeves, threaded clamp ring and mating coupling nut incorporating visual inspection ports Fast assembly is achieved via single threaded connection intended for use with standard commercial spanner wrenches Unit is available in 1½, 2, 3, and 4-in sizes, in aluminum alloy or steel Claim is, that compared to conventional AN union aluminum coupling affords weight saving of ½ lb in 1½ in size

Aids Acceleration Studies

Accelerometer tube DDR100, for accurate measurement and recording of acceleration by electronics is offered by **Mullard Electronic Products, Ltd**, Century House, Shaftsbury Ave, London W C-2, England. Device is basically similar in construction to all glass valve of loctal type, and may be mounted in any attitude This feature, coupled with tube's high output and response at low and zero frequencies, is stated to enable advantageous use as low mass pick up for measuring and recording acceleration and vibration of high velocity elements. Chief advantage resulting from high output tube is observation and recording of acceleration without necessity for special high gain amplifier in some flight tests Unit, also applicable for measuring and recording vibration and displacement velocity, is double diode with anodes elastically supported so that anode impedance is varied when tube is subjected to acceleration Frequency range over which response to sinusoidal acceleration can be considered independent of frequency is 0 to 250 cps. Resonant frequency is 1 kc/sec and maximum acceleration range is 100 G Tube is designed for heater voltage of 6 3 and maximum anode voltage of 10 Seated height is 2 48 in



For Flight Measurements

Data recorder mechanism Type MR-4, produced by **Cook Research Laboratories**, 1457 Diversey Parkway, Chicago 14, Ill., is designed for use with suitable coupling equipment and sensing instruments as a complete recording system Small size (8 × 3⅞ × 2¼ in) and light weight (24 oz) make it especially suitable for applications requiring measurement of such factors as accelerations, stresses temperatures pressures, vibrations, etc, in airborne equipment, flight testing, and guided missile work Stated to be capable of withstanding shock accelerations up to 75 Gs device uses magnetic tape to store variable or transient data for later re-running and analysis It is miniature 13 channel unit, includes one reference frequency oscillator plus 12 information channels and has recording time of 2¼ min

LETTERS

ILS In Canada

I have followed with interest the published reports of differences of opinion between Army, Navy and commercial airlines on the two best known systems of instrument let downs—GCA and ILS . . . While the competitive spirit which exists between the multitude of commercial airlines in the U S, and the Air Force and Navy is no doubt a stimulating factor in maintaining the efficiency of the airlines, it would appear that in the instance of instrument approaches, at any rate, it has held back rather than encouraged the development of this important aspect of commercial aviation

It is interesting to note that Trans-Canada Airlines, Canada's nationally owned airline, has made this decision without pressure of either competition or the armed forces, and is successfully using ILS to bring its aircraft in under conditions of almost zero visibility

We your Canadian cousins, are naturally very proud of the unequalled safety of our national airline, and it gives us a nice feeling of confidence to know that TCA and our Federal Department of Transport have taken the long forward step of installing instrument landing equipment at all our major airports across Canada

Incidentally, my own copy of AVIATION WEEK is read avidly by our staff and Club membership as soon as I take it out to our Club House each week Keep up the good work

E. M PRITCHARD, President
Brant Norfolk Aero Club
Brantford. Ontario. Canada

Schweizer's Sailplane

We were well pleased with your article (Schweizer's All-Metal Sailplane) Feb 7. In general it is concise and full of pertinent material in keeping with AVIATION WEEK style

Our market is still so limited that it is very difficult to get a ship of this class on the market but interest is growing Our designs have attracted considerable interest abroad in comparison to the usual foreign type of wood and plywood construction, but exports have been very limited due to the dollar problem This type of sailplane has attracted the interest of airline pilots and private pilots who are looking for a real sport aircraft

ERNEST SCHWEIZER, President
Schweizer Aircraft Corp
Elmira New York

Yearbook Mail

Following are a few of the congratulatory letters received after publication of AVIATION WEEK'S *Yearbook edition of Feb 28*

May I add my congratulations to the avalanche of happy letters which must be hitting your office on the superb job you and your staff did . . . It immediately became indispensable in this office . . . As an ex-editor of a magazine I feel qualified to appraise the inventory as an editorial masterpiece

R. E. DEMME
Asst Director of Public Relations
American Overseas Airlines
New York, N Y

I am sure you are receiving many congratulations on the excellent issue . . . It is one of the most useful volumes that any aviation publication has produced in recent years . . . The whole industry really owes you a big thanks

E. E. HENKEL, Public Relations Director
Simmonds Aerocessories, Inc.
Tarrytown, N Y

I very much appreciate your courtesy in forwarding a copy of AVIATION WEEK, dealing with the Inventory of U S Air Power I shall certainly find this publication most useful

OWEN BREWSTER
U S Senate
Washington, D C

Ship at once 30 copies Feb 28 issue Wire if available and when

CHAMPION SPARK PLUG CO
Toledo, Ohio

"Everybody's Business"

Your recent editorial "Air Power is Everybody's Business" could appropriately be the theme of the effort now being made by the non-scheduled air carriers to force the Civil Aeronautics Board to open to the public the controversy now in effect

The immediate effort is to have a public hearing on the proposed revision of Section 292 1 which is as vicious an example of bureaucracy in action as can be found In this battle for a fair hearing and a fair trial we have been joined by the Port of New York Authority, the City of Detroit and probably many other interested groups

. . . In the name of good government justice, and the future of American aviation we ask your aid in bringing into the open this struggle which is "everybody's business"

MELVIN C. REHILL
Vice President
Meteor Air Transport Inc
Teterboro New Jersey

Dispatchers Role

I have just read the article by Charles Adams in your Jan 17 issue, "Scheduled Lines Top Safety Record" This achievement is noteworthy not only because of the merited satisfaction to those of us within the industry, but for the healthy effect that safe operation is bound to have on selling flying to the travelling public

If I may be permitted to "view with alarm" for a moment, I would like to call special attention to the paragraph in the article devoted to the not-quite so good record of the non sked operators The Air Line Dispatchers Assn (A.L.D.A.) is currently conducting an intensive campaign to stress to the carriers, the C.A.A. and CAB, as well as the public in general, the very important part played by the flight dispatcher in the conduct of safe flight In this regard, the certificated dispatchers as represented by A.L.D.A cannot help but feel that the nonskeds would have a better record if the (GCA) system now set forth in C A R were extended to include the nonskeds

A perusal of accident investigation reports over several years seems to bear out our theory that the teamwork between pilot and dispatcher as set forth in the regulations is the best insurance against "human error" accidents that has been devised to date The fact that the regularly operated, even though unscheduled, carriers are permitted to carry passengers without this safeguard is to us an unthinkable situation, and we feel that if the public knew the facts the Board would be compelled immediately to act to provide ground-control and the certificated dispatch of these carriers

A careful pilot in the cockpit working in conjunction with a conscientious dispatcher on the ground is a team that can figure a way out of many hazardous situations that could otherwise result in fatal accidents

My congratulations to your publication for the fine manner in which you have presented safety developments . . .

JAMES H PAIST
Chairman, Safety Committee
Council #2
NWA division of ALDA
Minneapolis, Minn

FINANCIAL

Outlook Good for Growth Capital

Aircraft builders expected to have little difficulty obtaining funds to meet sudden growth requirements.

Current capital requirements of the aircraft industry are producing assorted stresses and bulges in the finances of individual companies

A number of aircraft builders holding relatively large military contracts have resorted to bank loans and sought larger advances from the Air Force and Navy But in a few instances, net working capital is far in excess of requirements to finance current backlogs

There is no exact formula to determine the amount of working capital an aircraft company should have to finance a given volume of business The peculiar contracting nature of aircraft manufacture makes the industry unlike any other standard business where ratios and measures are commonplace

▶ **Highs and Lows**—It is obvious, for example, that a working capital of more than $100 million is excessive in financing a backlog of less than $150 million which is the situation of one company By contrast another company with a current backlog estimated at $255 million last reported net current assets of more than $31 million A third last reported working capital of about $92 million against an estimated backlog of $335 million

Despite the present demoralized condition of aircraft securities the industry should have little difficulty in obtaining capital to finance any sudden expansion of production The re-appearance of large U S orders, together with the hope of profitability can restore excellent credit ratings to the industry almost overnight

Prior to the war, the aircraft industry enjoyed very simple capital structures In most instances common stock represented the sole capitalization From 1935 through 1944, every company was able to obtain additional equity capital through public financing

This was done by selling convertible preferred and common stocks as market conditions dictated This was highly feasible as the group had wide popular appeal as a "growth" industry with its sales showing a strong upward trend This new financing was adequate to meet working capital requirements and cover immediate losses As long as favorable earnings prospects prevailed, there was little difficulty on the part of any of the companies in successfully accomplishing public financing

▶ **Sales vs Investment**—During the war tremendous volume of sales were handled on a relatively small amount of equity capital For instance, the peak sales of $8,203,847,000 billed in 1944 by the old-line aircraft manufacturers were realized with an average equity investment of only $420,247,000 This condition made for considerable leverage in earnings on net worth

This huge volume of sales on limited net worth positions was greatly facilitated by a combination of factors Advances from customers, principally the government, provided much working capital Notes and loans payable were another important source of funds The loans were primarily of the "V" type and in view of their outstanding success may again be applied should the need ever arise

▶ **"V" Loans**—This financing instrument was authorized through an executive order issued in March, 1942, by President Roosevelt based on the War Powers Act of 1941 As a direct result Regulation V was issued by the Board of Governors of the Federal Reserve System to control the operation of this form of financing

Among other provisions, commercial banks made the loans but were guaranteed against loss up to a stipulated percentage, usually about 80 percent, through the Federal Reserve Banks

There was no limit on the size of the loan For example, General Motors Corp had an agreement covering a billion dollars But very little of this was drawn down

These loans did not preclude cash advances being made by the War and Navy departments to contractors However, it was far more desirable to have a line of credit constantly available rather than be dependent upon the time consuming process of securing advances from the services

Commercial banks were free to assume the entire risk of these loans, if so inclined In fact the more of the loan that remained unguaranteed the greater the profit Regulation V provided for a graduated scale of fees, in terms of a percentage of interest payable by the borrower which the commercial bank was required to turn over to the guarantor agency in consideration for the assumption of the risk involved Most banks were inclined to "share" their risk with the government and were delighted to pay the small premium for the insurance thereby afforded them

The "V" loans further acted as a safety valve against abrupt contract terminations and greatly facilitated the liquidation of portions of inventories This regulation expired with the termination of most of the provisions of the first War Powers Act

The entire "V" loan program accumulated a wealth of experience with most technical procedures well defined Official sources expect to implement this same instrument as a constructive financing aid should the need again rise for a similar procedure

▶ **Term Loans**—In the meantime term bank loans are being adapted to finance special capital requirements of a number of aircraft companies Under this form of financing a bank or a group of banks arrange a revolving credit available during a short period At the expiration of that short period the total of the loans so drawn are funded generally on a three- to five-year basis In other words, the aircraft builder amortizes the loan over the term specified

The Reconstruction Finance Corp continues as a major factor in furnishing financial assistance when such aid is not forthcoming from regular commercial banking channels Recently the RFC advanced Glenn L Martin Co an additional $2,800,000 evidenced by 4 percent secured notes due Jan 15, 1950 At the year-end, the company showed previous indebtedness to the RFC amounting to $16,422,047, at the same interest rate and with maturities adjusted through 1950 A few years ago, the Guaranty Trust Company of New York advanced a loan to Martin but the RFC subsequently replaced this advance with a larger one of its own

With the industry forced to carry inventories for longer periods than first anticipated, bank credits have appeared necessary For the most part, normal commercial banking associations have provided whatever credits have been required

It is noteworthy that labor, material and overhead costs are currently running at a rate more than double that of prewar levels Experimental and development costs are estimated to average ten times that of prewar levels This factor emphasizes the need for increased capital resources

While banks have been cautious in their recent attitudes toward the aircraft industry as long as the backlogs appear secure, the quality of the managements satisfactory and the prospect for earnings encouraging, the credit accommodations have been forthcoming This pattern is likely to continue in the immediate future

—Selig Altschul

Contest Pits Bonanza vs. Navion

Two owners in Albuquerque compare takeoff and landing performance of both craft in actual competition.

Comparisons are inevitable between two airplanes as closely competitive as the Beech Bonanza and the Ryan Navion in size, capacity, configuration, power and price

Manufacturers thus far haven't made any comparisons in actual competition, but a recent contest by owners at Albuquerque, N M, won by the Navion, demonstrates the keen interest of the plane owners and pilots in takeoff and landing performance

▶ **Industry As Sponsor**—Possibility is seen that such local contests as the one at Kirtland Field, might lead to some form of official industry sponsored four place plane touring contest Similar contests in Europe in the early 1930s contributed much to new plane design innovations They were based on landing and takeoff performance, economy of operation and similar practical considerations, as well as speed

By directing design attention to these characteristics, competitions should result in additional improvements of the planes which in turn could stimulate currently lagging aircraft sales

▶ **Professional Pilots**—It is not likely that any better short landing and takeoff performance would often be required than that shown by the two competing planes at the relatively high altitude (5365 ft) at Albuquerque Both pilots were professionals and no doubt got more performance out of the planes than the ordinary private or business man pilot might get

Also in consideration is the fact that neither plane carried full load, the contest being conducted with pilot only in each plane, plus full gas load

The two planes, as is generally known, are both four-place all-metal low-wing monoplanes with retractable tricycle landing gear, and controllable propeller Both are powered with the Continental C 185 engine Both sell in the $10,000 price bracket

According to reports received by Aviation Week, the Navion made a 330 ft takeoff measured from starting point, and landed in 348 ft after coming in over seven ft obstacle located 30 ft from the end of the runway The Bonanza made a 395 ft takeoff and a 407 ft landing under similar conditions

▶ **Wind and Witnesses**—Control tower records indicated the wind was two miles stronger for the Bonanza takeoff than at the time of the Navion takeoff and was four miles stronger at the Bonanza landing than at the Navion landing

Carl Logan, Leoti, Kan., farm implement dealer, and owner of the Navion, supplied the performance data and lists 10 witnesses of the competition in addition to two CAA men who watched from the tower

W P Cutter of Cutter Carr Flying Service, Albuquerque who piloted the Bonanza in the trial, advises Aviation Week that it is impossible to confirm the exact figures and wind variation, and states he would welcome a completely official demonstration of these two fine airplanes at any time

"I am sure no one had a tape measure near the runways, at least near the time I took off," Cutter states "The only CAA employes who could have possibly witnessed any takeoffs or landings while I was flying a Bonanza from the field would have been the control tower operators They were located one half mile from point of takeoff and in front so it would have been impossible for any of them to judge within several hundred feet any difference in takeoff distance of planes which might have used the field that day"

▶ **Navion Two Years Old**—Logan states that the Navion was piloted by Reinholdt Dernes, operator of Garden City (Kan.) Aviation Sales and Service and that the plane used, North American Navion NC 8698H is approximately two years old and has approximately 1000 hr flying time The Bonanza was "a fairly new A35 model NC number unknown"

"Field elevation was 5365 ft Both planes completely filled with gas Take-off distance measured from starting line Landings measured from seven ft obstacle to stopping point"

Logan reported that he had been "ribbed" every time he landed at Albuquerque "by different ones" that the Beech would outperform the Navion on takeoff and landing and that the competition was arranged to settle the argument

An Albuquerque dateline story in the San Diego Sun quotes Clinton C Seymour, Albuquerque oil man (named as a witness by Logan) as saying that he lost $750 in a wager on the contest Seymour is a Bonanza owner

A letter from CAA regional office at Ft Worth says the chief airport traffic controller at Kirtland Field "informs us that a takeoff and landing contest did take place at Kirtland Field on Feb 13, 1949, between the types of aircraft mentioned However, no control tower personnel participated in this contest Tower personnel only observed the contest in their regular line of duty of controlling air traffic The contest was conducted at the extreme north end of the north south runway and personnel in the tower were in no position to determine the results of the contest due to the distance of approximately one mile from the tower to the takeoff and landing point "

Logan lists the following witnesses

"CAA men who witnessed from the tower were J L Allen and David Schmuck, both of Kirtland Field

"Other witnesses Pat Kane, fire chief of Kirtland Field, Bob Stubble field, chief pilot for Cutter Carr Flying Service, Dan Mueller, El Paso Navion dealer, Clinton Seymour Albuquerque oil man, Frank Pierich, secretary to Seymour, Lowell Baker Albuquerque, L R Crist and John Wheeler both of Garden City Kan, Robert Shumaker, Wakeeney, Kan and Logan"

Tips on Tires

The Rubber Manufacturers Assn recently made recommendations for proper handling of aircraft tires and tubes during storage The following procedure will help eliminate conditions which may cause rubber deterioration during tire storage in airplane factories or while they are on aircraft during assembly, overhaul or modification

- **Mounted and in storage**—Inflate until beads are properly seated, reduce air pressure to not more than five lb per square inch, keep covered with paper or canvas to prevent circulation of air and access of light
- **Unmounted and in storage**—Keep covered with paper or canvas to prevent circulation of air and access of light
- **On aircraft in assembly**—Inflate tires to pressure required to carry weight of unloaded craft, keep tires covered with fitted canvas covers to prevent circulation of air access of light and damage by oil or gasoline
- **On aircraft in overhaul, modification or storage**—Keep tires inflated to correct pressure for imposed load, keep covered with fitted canvas covers to prevent circulation of air, access of light, and damage by oil or gasoline

BRIEFING FOR DEALERS & DISTRIBUTORS

AIRCRAFT SHIPMENTS—Unofficial reports by principal personal aircraft companies on February shipments showed a total of 224 planes shipped of which 153 were four-placers and 71 two placers Cessna and Piper, leaders in the 1948 sales, have their positions reversed thus far in 1949 shipments Cessna reported 35 planes delivered in January, and 59 in February for a total of 94, while Piper reported 48 in January, and 72 in February, for a total of 120

The purchase of the Stinson Voyager by Piper last fall appears to be more and more of an advantage, as 54 of the planes shipped by the Lock Haven, Pa., manufacturer in the two months were Stinsons With an official January shipment total of only 152 planes for the ten companies reporting, this makes a two months total of only 376 planes

The first two months of any year are not a good index to annual sales for planes as long as the weather factor in lightplane usage remains as important as it is today But the first two months of 1949 give no indication that the personal aircraft business is doing even as well as it did in 1948 First two months sales for 1948, lowest postwar year so far, were 888

MORE NAVION BUSINESS USES—As further evidence of the utility of today's four-place planes, Ryan Aeronautical Co. cites sample reports from Navion business users Guntert & Zimmerman, Stockton, Calif., hauls heavy machinery parts and mechanics to repair breakdowns and makes the plane double as an executive transport, Hendrix Manufacturing Co., Shreveport, world's largest producer of dragline buckets for excavating, makes airplane calls on company distributors throughout the 48 states; personnel of Masoo Awning and Manufacturing Co., Dallas, visits 55 manufacturing plants under franchise in 44 states; Stoddard Manufacturing Co., Mason City, Iowa, sells commercial refrigerators, has a sample home freezer locker in the Navion's luggage compartment for demonstration purposes

NEW POWERPLANT MANUAL—CAA has announced a new Aircraft Powerplant Handbook, replacing the old Civil Aeronautics Bulletin No 28, pilot's powerplant manual, widely used in pilot training before and during the war New edition includes material on turbojet, turboprop and compound engines, as well as conventional powerplants

STOCK OVERHEADS vs DISCOUNTS—Principal aviation wholesalers and distributor houses are making a strong effort to convince some of aviation's biggest quantity consumers, such as the airlines, that the privilege of buying large quantities of goods at discount direct from the manufacturers is not an unmixed blessing

In many cases, they assert, even the big consumer can save money and avoid tying up his capital in large parts and equipment stocks for a long period by making use of the distributors' facilities Speech made to the airline purchasing agents at a meeting in St Louis sponsored by Air Transport Assn., by George W Jalonick, III, Southwest Airmotive vice president, was just part of a campaign which Aviation Distributors and Manufacturers Assn is conducting

SPORTSMAN SHOW RESULTS—Recap of the recent personal plane displays by New York area distributors of Beech, Cessna, Piper and Ryan at the National Sportsman's Show in Grand Central Palace, New York City, last month, showed the five planes were looked over by nearly 200,000 sports enthusiasts who visited the show

Four bonafide "over the-counter" sales at the show, and good-sized lists of solid prospects, were more tangible evidences that the sports angle of personal planes has been perhaps underplayed in the recent effort to stress business utility

Planes and exhibitors included Bonanza, shown by Atlantic Aviation Corp., Cessna 170, shown by Personal Aircraft Sales Piper Clipper and Piper Stinson shown by Safair Flying Service, and Ryan Navion, shown by Mallard Air Service

—ALEXANDER McSURELY

1948 Feederline Traffic

Carrier	Rev. Pass. Miles (add 000) 1948	1947	Pass Load Factor 1948	1947
Challenger	5,352	2 489	19 33	19 50
Empire	4,768	2 510	25 25	27 74
Florida	1.659	901	25 59	17 35
Monarch	6,790	3,916	22 91	19 41
Piedmont	9,296		27 61	
Pioneer	25 080	16 513	30 47	32 16
Robinson .	1,214		32.87	
Southwest .	17 785	14,975	34 37	41 43
Trans-Texas	5 396	311	13 93	6 75
West Coast	8,635	4.803	35 79	29 60
Wisc Central	1,953		28.06	
Totals	87,928	46,418	27 14	29 85

Time Running Out for Feeders

Five franchises expire this Fall; with traffic not up to expectations, CAB takes dim view on extensions.

By Charles Adams

With the death sentence already applied to one of their number by a tough minded Civil Aeronautics Board, the nation's feederlines have been placed on notice that they have comparatively little time remaining to justify their claims to a longer lease on life

Hampered by lack of capital, poor airport and airways facilities, rising costs and the difficulty of overcoming customer resistance to short-haul air travel, a number of feeders have failed to generate the volume of business they had optimistically predicted in applying for certificates In several instances, passenger traffic already has leveled off at a discouragingly low point

Last of the short-haul certificates issued by CAB (to All American Airways) will not expire until January 1952 But franchises of five feederlines are due to run out this fall—and four others terminate during the first half of next year

► **Program For 1949 Outlined**—Within the next few weeks, CAB expects to offer several short-haul operators five year certificate extensions, with certain modifications in the existing route patterns Less fortunate feeders will be told to show cause why their franchises should not be terminated on the presently designated expiration date

Similar orders will be issued to other short-haul operators throughout the year Treatment accorded each feeder will depend upon its individual record in developing traffic, prospects for future progress, and the ultimate cost to the government in supporting the operation through mail pay subsidies

► **Seven Lines Still Inactive**—Of the 19 feeder and approximately 27,000 miles of routes authorized by CAB, seven systems with over 11,000 route miles have never been activated In addition about 2500 miles of routes certificated to active feeders were not in operation by mid March

Short-haul operators which have not started any service Arizona Airways Phoenix Central Airlines Oklahoma City Okla Iowa Airplane Co, Des Moines Parks Air Lines, East St Louis, Ill Roscoe Turner Aeronautical Corp, Indianapolis Ind Southern Airways Birmingham, Ala., and Wiggins Airways Norwood, Mass CAB has warned these carriers that unless operations are inaugurated by the end of 1949, the franchises will be withdrawn

► **Florida Airways Decision**—First casualty in CAB's reassessment of its postwar feeder experiment was Florida Airways smallest of the short-haul operators The Board this month reaffirmed its decision of last September and refused to extend Florida's certificate beyond Mar 28

"The conclusion is inescapable" CAB declared "that Florida Airways' route is an uneconomical one No substantial increase in non-mail revenues can be expected in the reasonably foreseeable future, and further expenditures of public funds will not help to develop it into a route than can be operated at a reasonable cost to the government commensurate with the service rendered"

Comparing Florida Airways with six other feeders, CAB found the carrier had the lowest revenue passenger and mail ton mileages and the least number of revenue passengers per station, per plane departure per route mile and per revenue plane mile During the first six months of 1948, Florida carried an average load of 2 07 persons on its eight-passenger Beech D 18Cs, but this figure dropped to 1 98 during the last half of the year

► **High Mail Pay Subsidy**—Of Florida's $759 335 in operating revenue during 1948 $655,712 was derived from mail pay and only $91,278 from passenger traffic Post Office Department pointed out that the government paid Florida about 30 cents for each air mail letter carried an average of 122 miles This compares with a nationwide average payment of 6 74 cents for an air mail letter carried 1401 miles

Post Office said the cost in mail pay for Florida's operation was "out of all proportion to the service rendered and reasonably adequate postal service can be given all points on the route by other available transportation facilities" CAB added there was no evidence that Florida Airways could make any substantial contribution to the national defense which would justify its continued existence

Although Florida as the smallest feeder carried fewer passengers than any other short haul operator active during all of 1948, its average passenger load factor stacked up well against the field From an average of 17 35 percent in 1947 the company boosted its seat occupancy to 25 59 percent in 1948

► **Load Factors Compared**—By contrast several other feeders using larger equipment failed to improve their load factors in 1948 over 1947 Challenger Airlines dropped from 19 50 percent in 1947 to 19 33 percent last year Empire from 27 74 to 25 25 percent, Pioneer from 32 16 to 30 47 percent and Southwest from 41 43 to 34 37 percent Opening of new links and a shift to bigger planes accounted for part of the drop in certain cases

But the feeders as a whole (with more companies in operation) flew 87 928 000 scheduled revenue passenger miles in 1948 an increase of nearly 90 percent over the 46 418 000 reported for 1947 Passengers carried increased from 235,585 to 425 695 express ton miles from 117 523 to 189 550, freight ton miles from 62,039 to 264,794 and mail ton miles from 167 564 to 361 984

► **Trunklines vs Feeders**—In aggregate the feederlines last year flew less than 2 percent of the revenue passenger miles accounted for by the 16 domestic trunklines They flew less than 1 per-

cent of the mail ton miles reported by the trunklines, yet their mail pay of over $10 million was more than 20 percent of that received by the long-haul domestic operators.

With the aid of higher mail pay, the feeders as a group broke even last year. Highest net profits were shown by Empire ($283,021) and Pioneer ($119,532). Whether the government will assume the cost of liquidating feederlines put out of business by CAB has not yet been determined.

Willis Shows Profit

Bolstered by heavy aircraft maintenance contracts, Willis Air Service, Inc., Teterboro, N. J., air freight operator, reports a net profit of $41,000 before taxes on a gross business of $1,150,000 for year ending Dec. 31, 1948.

With two C-47s serving cities along the eastern seaboard from Massachusetts to Florida Willis employs around 220 employes for both airline and maintenance operations and had a total gross payroll last year of $720,000.

Willis Rose Corp., formed on Oct. 1, 1948 to perform maintenance at New York International Airport, represents an investment of $101,000 and has been designated by Douglas Aircraft Co. as as service center for New York area.

Two Carriers Test CAB Skycoach Policy

Development of skycoach services by the certificated domestic airlines is reaching a critical stage despite apparent success of the low-fare flights wherever they have been permitted to operate.

The Civil Aeronautics Board must soon decide whether, for the present, scheduled tourist-class service should be continued only as a small scale experiment or should be allowed to expand throughout the nation. Test of Board policy is being provided by Capital Airlines and Northwest Airlines, which have proposed important extensions of their existing skycoach operations.

▶ **CAB Policy Outlined**—In its recently announced economic program for 1949 (Aviation Week, Mar. 7), CAB said that "until a downward trend in airline operating costs is apparent, the general fare levels should not be adjusted downward." But it added that exceptions should be made for experimental and developmental service designed to operate at less than normal costs and with rates aimed at securing new traffic.

The Board declared that prompt action is required to explore the possibilities of additional coach-type service. Consequently, it is expediting the U. S.-Puerto Rico and U. S.-Alaska route cases which include tourist-class service proposals. And CAB has promised early hearings on the need for scheduled transcontinental coach service.

United Air Lines, a bitter foe of domestic tourist-class operations since their inception last fall, is strongly opposing the new 4-cents-a-mile tariffs filed by Capital and Northwest. NWA wants to start skycoach service between New York and Seattle via the Twin Cities and other points, on Mar. 24 with 56-passenger DC-4s. Capital wants to extend its low cost 59-passenger DC-4 operations to the New York-Twin Cities run on Mar. 24 and to the Washington-Chicago link Apr. 1 (Aviation Week, Mar. 7).

▶ **High Load Factor Reported**—Capital Airlines President J. H. Carmichael reported recently that the overall passenger load factor on his New York-Chicago coach service from Nov. 4, when flights began, to Mar. 1 was about 77 percent. Breakeven point is considered to be around 50 percent.

In the four-month period, Capital skycoaches flew 13,000 passengers on the New York-Chicago route, Carmichael declared. By comparison, the company's full-fare flights handled little more than 1000 passengers between the same two points during all of 1948.

Northwest has been operating combination passenger/cargo DC-4s at skycoach rates on its Seattle-Alaska route since January, providing fierce compe-

RIBS AND CURVES

This double-decked fuselage, adorned with hostesses from six carriers that have ordered Boeing Stratocruisers, is United Air Lines' reminder that it expects to start taking delivery on seven of the 71-ton ships this summer. UAL's version of the Stratocruiser will seat 55 passengers and carry 17,000 lb. of mail and cargo. Hostesses shown above represent, left to right, United, Northwest, American Overseas, Pan American, BOAC and Scandinavian Airlines System.

tition for the many nonscheduled carriers on the route. NWA says that because of the success of the four-times weekly Seattle-Anchorage skycoach service it has asked CAB to authorize similar low fare flights between the Twin Cities and Alaska via Edmonton, Canada, starting Apr. 25.

The $97 New York-Seattle skycoach fare proposed by Northwest would permit that carrier to undercut the $99 rate being offered by a number of transcontinental nonscheduled operators. Planes would take off from both New York and Seattle about midnight.

▶ **TWA Announces Results**—Meanwhile, TWA has reported that its first tourist-class operation inaugurated early in February between Kansas City and Los Angeles, has proved a "roaring success." During the first 30 days of the experiment, TWA's 24-passenger DC-3 skycoaches averaged 13.3 passengers per mile, compared with 6.7 on TWA's other DC-3 flights west of Kansas City during February.

TWA's sales research department states that insofar as it can determine, the skycoach passengers were not obtained at the expense of other equipment operated over the same route. To date, eastbound traffic has been considerably better than westbound.

Latest scheduled domestic skycoach operation was started early this month by Mid-Continent Airlines between Kansas City and Minneapolis/St. Paul via Omaha and other points. As in the case of similar tourist-class services, fares average around four cents a mile (about one-third less than first-class rates). MCA's northbound flight leaves Kansas City at 1 am., and the southbound departure from the Twin Cities is at 1:15 am.

▶ **Suspension Requested**—United Air Lines has asked CAB to suspend, pending an investigation, the new skycoach proposals of Northwest and Capital. It argues that four cents a mile rates are unreasonably low, being considerably under first class rail fares and, in some instances, less than rail coach fares.

UAL said it can already trace diversion of its traffic because of Capital's New York-Chicago skycoach operation. Experience to date does not indicate Capital's low fare flights have developed much new traffic, and there are indications that Capital's skycoach load factors have fallen off substantially since the holiday season, United told CAB.

According to United, Capital's proposed new skycoach rates go as low as 3.8 cents a mile, and in some instances are 40 percent below the existing first-class air fares. Northwest's proposed new tourist fares represent a cut of up to 44 percent between certain points on the transcontinental route, UAL asserted. "If CAB desires to conduct fur-

ther experimentation with reduced fares, it should limit such rates on the part of Northwest to noncompetitive segments," United concluded

Employees Reassured By WAL President

Western Air Lines President T C Drinkwater has advised company employees that "there is no cause for alarm" in CAB's recently-launched investigation into WAL's route structure

The present action definitely is not a dismemberment order, Drinkwater declared "It indicates only that the Board intends to make a complete survey, through public hearings, of the relationship of our routes to the overall domestic air transport pattern

▶ **Possible Benefit Seen**—"It is by no means a foregone conclusion that harm will come to Western as a result of this investigation It is conceivable ... despite CAB's shifting and perplexing policies ... that substantial benefit may result through improvement of our present system."

CAB's orders investigating Western and Northeast Airlines (AVIATION WEEK, Mar 7) were issued to determine whether it would be in the public interest to merge part or all of the carriers' routes with those of other companies, whether alteration in suspension of all or part of the carriers certificates may be required, and whether equipment interchanges should be instituted CAB previously had denied that a similar probe of National Airlines constitutes a "dismemberment proceeding"

▶ **Continental Eyes Inland**—Drinkwater deplored the "ill-advised comment by uninformed airlines' which indicated they were prospective purchasers of part of Western's routes He apparently referred to the statement of Continental Air Lines President Robert Six that Continental was interested in acquiring WAL's Inland division Six said that ever since Western sold its Los Angeles-Denver route to United Air Lines in 1947, Inland has been a step child obligation of WAL

Continental has tried repeatedly to negotiate with Western for purchase of Inland Six asserted that these efforts have been "stalemated by Western's lack of interest and cooperation."

▶ **Slow Action Expected**—Drinkwater believes action on CAB's new investigation of WAL "is unlikely for many months to come" in view of the Board's limited staff and more vital cases now pending. He said Western could show a record of sound progress during the past two years, having reduced costs substantially despite the inflation spiral

"We are about the only airline that still doesn't have 'expansionitis'," the WAL president declared We were the only carrier to withdraw all our new route applications away back in 1947. We are among the leaders in the industry in consolidation of ground facilities And although it may be a mistake, we are the only U S trunkline that does not maintain at least one Washington CAB lobbyist'

Damon's Salary Tops Airline Executives

Ralph S Damon, who moved from the presidency of American Airlines to the presidency of TWA last January, simultaneously jumped to the top rung of the salary scale for industry executives

In his new job as TWA president and director, Damon will receive $75,000 annually During 1947—latest year for which complete figures are available—C R Smith, formerly American Air lines board chairman and now president of the company, had the industry's highest salary, $60,000 Damon received $40,000 during the same year

Official disclosure of Damon's salary with TWA was contained in a petition to CAB asking approval of his election as director of Goodyear Tire & Rubber Co He will receive $200 a month plus $200 for each meeting attended as Goodyear director The petition said Damon holds 1300 shares of TWA stock.

▶ **Raise for Woolman**—Meanwhile, reports to CAB show that C E Woolman, president and general manager of Delta Air Lines, was paid $24,000 in 1948 against $18,000 in 1947 He held 32 307 shares of Delta common stock on Dec 31, or 6 4 percent of the shares outstanding

Hawaiian Airlines President Stanley C Kennedy received $14,400 last year against $6240 in 1947 J H Connelly, president of Southwest Airways, was paid $10 000 in both 1948 and 1947 Joseph I Dyer Florida Airways president and general manager received $12 629 in 1948 against $7083 in 1947, and R M Wilson executive vice president of Monarch Air Lines was paid $9000 in both 1948 and 1947 Leland Hayward board chairman of Southwest H S Darr, president of Monarch, and F W Bonfils, MAL board chairman received no compensation from their companies in either of the past two years

Other industry salaries for 1948, with 1947 compensation in parentheses

▶ **Delta**—C E Faulk, board chairman $12 000 ($10 000) Charles H Dolson vice president-operations $16 000 ($17 040) Laigh C Parker vice president traffic $18 000 ($12,000) T B Judd comptroller and assistant secretary $10 500 ($9600) M S Biedenborn vice president no salary either year Travis Oliver, treasurer $1200 ($1200) C H McHenry secretary $1200 ($1200) Catherin Fitzgerald assistant treasurer $3900 ($3075)

Only person besides President Woolman listed as holding more than 5 percent of Delta n stock on Dec 31 1948 was R J Reynolds Winston Salem N C who had 117 210 shares or 23 75 percent.

▶ **Hawaiian**—Alexander Smith vice president and secretary $14 000 ($13 800) Ford Studebaker vice president $14,000 ($13 800) David Watson treasurer $11 000 ($7763) Raymond G Laclergue assistant treasurer $5800 ($7484) Inter Island Steam Navigation Co held 152 782 shares or 57 31 percent of Hawaiian's common stock on Dec. 31.

▶ **Southwest**—T R Mitchell vice president $9000 (none). A W Johnson treasurer, $9000 ($9000) Walter Roche secretary none (none) C. H Sullivan assistant secretary and counsel $7200 ($7200) Persons holding more than 5 percent of SWA's stock at the end of last year were J H Connelly 146 252 shares or 22 39 percent Leland Hayward 143 538 shares or 22 23 percent and Gilbert Miller New York 38 188 shares or 5 98 percent.

▶ **Florida**—Marion D Holman vice president $9788 ($9510) Oscar Bergstrom, vice president $9831 ($9503), M J Brown secretary-treasurer $9471 ($9502) Persons holding more than 5 percent of the stock on Dec. 31 1948 were J B Dyer Jr Orlando Fla, 33 600 shares or 30 24 percent and R J Reynolds Winston Salem N C 25 000 shares or 22 37 percent.

▶ **Monarch**—C A Myhre treasurer $6300 ($4900) E N Levin secretary none and D T Myers assistant secretary, $2025 ($1690) Holding more than 5 percent of MAL's stock at the end of last year were Darr Aero Tech Chicago 24 790 shares, or 52 percent Wilson-Bonfils Flying School, Denver 16 560 shares, or 35 percent and R. M. Wilson, 3027 shares or 6 percent

Money Saver

Gander CCA installation helps overseas carriers cut operating costs.

Ground Controlled Approach installations are helping Pan American Airways and other overseas carriers achieve substantial operating economies at Gander, Newfoundland, hub of North Atlantic air travel.

In an attempt to determine time required for a GCA talk-down landing, PAA recently ran a two week survey comparing radar approaches with the standard instrument approaches previously used exclusively. Under bad weather conditions—ceiling less than 1000 ft and visibility under two miles—GCA letdowns were found to be consuming eight minutes less time than instrument landings.

GCA approaches averaged 12 minutes each, and instrument approaches 20 minutes. Both were timed from a point 15 miles from the field until touchdown.

▶ **Savings Estimated**—PAA figures operating cost for each minute of flight with a Constellation is about $5. Thus each GCA landing results in an average saving of $40.

Pan American pointed out that the survey time for all instrument approaches includes only those in which no other flights were in the area. This eliminates entirely the time required in holding over the field waiting for earlier arrivals to land.

Arrival of five flights over Gander Airport within a short period of time is not uncommon. Thus, PAA states, it would be about 100 minutes before the plane which is No. 5 in the stack could come in for a landing under instrument conditions. GCA, on the other hand, could bring No. 5 down in 60 minutes—a saving of 40 minutes or $200 on that plane alone.

▶ **Fewer Schedules Disrupted**—Omitted in Pan American's time-cost survey was an estimate of the money GCA saved by landing planes that otherwise would have been diverted to alternate airports. That alone would result in considerable expense, with disrupted schedules and expensive transfer of passengers and cargo.

As indication of the use CCA receives at busy Gander Airport, Pan American noted that 3500 radar landings took place at the field during 1948. Of these, 1451 occurred when ceiling was under 1000 ft. and visibility less than two miles. The other GCA letdowns were considered as practice or training. All were without incident, according to PAA.

Airline Safety

The U. S. scheduled airline industry continued to sport a top-notch safety record as it moved out of the critical winter season.

As of Mar. 12:

U. S. feederlines had no fatal accidents since the first short-haul carrier started its operational service in August, 1945.

U. S. overseas flag lines had no fatal accidents since the Pan American Airways Constellation mishap which occurred at Shannon, Eire, Airport on Apr. 15, 1948.

U. S. domestic trunklines had no fatal accidents since the Northwest Airlines mishap at Winona, Minn., on Aug. 29, 1948.

American Airlines, largest domestic trunk operator, on Mar. 4, 1949 completed three full years without a passenger fatality.

During the period it flew eight million passengers 4,154,637,050 revenue passenger miles—equal to moving the entire population of New York City to the city of Detroit.

C. R. Smith, AA president, described his company's record as "unparalleled in the history of aviation." Several small U. S. carriers have either unblemished safety records since institution of service or clean records dating back as far as 20 years.

MANAGEMENT CHAT

TWA's problems, under discussion by Ralph S. Damon, left, new president, and Warren Lee Pierson, board chairman, have been eased considerably by CAB's recent decision offering the carrier $2,748,000 in retroactive domestic mail pay (Aviation Week, Mar. 7). Damon commented "We can only look upon the decision as a help in getting us on our feet, where we can fight our own battles." Pierson praised the mail pay order as "a constructive step."

SHORTLINES

▶ **Alaska Airlines**—Preliminary investigation of a DC-3 accident Jan 20 near Homer, Alaska, in which five persons were killed, disclosed that the plane hit 2800 ft up on a 3100 ft hill while in nearly level flight with normal operating power. No indication of power plant malfunctioning or structural failure prior to impact has been found, nor was there evidence of ice on the plane's surfaces. Weather at the time of accident was clear. Mishap occurred at night at a point nine miles from the center line of the unlighted airway.

▶ **American**—Plans to extend its family fare tariff from Mar 31 to June 30. AA first introduced the low-cost first-of-the-week fares last Sept 14 and has termed the move "an unqualified success." Sixteen other carriers which followed American in adopting the family fare plan also intend to continue their tariffs through June 30. They are Braniff, Capital, Challenger, Continental, Empire, Monarch, Mid-Continent, Northeast, Northwest, Piedmont, Pioneer, Robinson, Southwest, TWA, United and Western.

▶ **Canadian Pacific Air Lines**—Has leased 20 acres at Sea Island Airport, Vancouver, as main maintenance and repair depot for CPA's projected trans-Pacific operations to the Orient, Australia and New Zealand (AVIATION WEEK, Mar 14). Site taken over under a 20-year contract contains the facilities used by Boeing Aircraft of Canada to build Catalina flying boats and B-29 subassemblies during the war. Purchase cost of the hangar plus cost of renovation will be about $500,000. When in full operation, CPA's new Vancouver depot will employ about 1000 persons.

▶ **Eastern**—Has asked CAB for an exemption permitting immediate transcontinental service by EAL from the South and Southeast to San Francisco, Los Angeles and San Diego via El Paso, Phoenix, Tucson and other points. Eastern said it is able to commence flights over the route "at once."

▶ **Northeast**—CAB has turned down the carrier's request to establish, on less than regular 3-day notice, tariffs providing for a one-third fare reduction on unreserved seats sold for flights between consecutive stops on NEA's system. Under the plan (AVIATION WEEK, Feb 14), "go-show" passengers could travel on NEA at nearly ground transportation rates.

▶ **Northwest**—W F Richmond has been appointed system chief pilot re-

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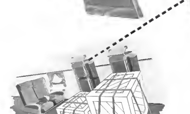

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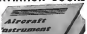

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placing Carl Luethi, who is on special assignment in connection with integration of Stratocruisers into NWA's scheduled service

▶ **Sabena**—Has taken delivery on the first of six Convair Liners The Belgian carrier will use the new planes on its European and African routes

▶ **Slick**—CAB has extended for six months the carrier's authority to carry military property only between U. S. Air Force bases

▶ **TACA**—Has cut air freight rates from New Orleans to Central America by about 20 percent on a variety of commodities

▶ **TWA**—Matthew J Plodinec has become acting controller, succeeding Leo R Gilleran, who resigned to become treasurer of Encyclopaedia Britannica.

▶ **United**—Plans to reduce its San Francisco Honolulu berth charge from $50 to $25 on Apr 1 . . . Systemwide arrivals either on time or within 15 minutes of scheduled time gained 14 percent in January compared with the same month a year ago

▶ **Western**—Has announced a joint tenancy agreement with Pan American Airways whereby the latter will move from its location on the south side of Los Angeles Airport to new quarters in WAL's terminal building, hangar and general offices on the north side of the field

▶ **Wisconsin Central**—Has inaugurated feeder service to Brainerd, Minn

CAB SCHEDULE

Mar 21—Hearing on Florida trunkline service case (Docket 2215 et al.)

Mar 21—Prehearing conference on New York area helicopter service case. (Docket 946 et al.)

Mar 23—Hearing on TWA's complaint against Pan American Airways' Saudi Arabian service (Docket 3264)

Mar 24—Prehearing conference on amendment of Scandinavian Airlines system's trans-Atlantic route (Dockets 3342 and 1550)

Mar 28—Hearing in New England states route case (Docket 2196 et al.)

Mar 28—Hearing on Board's enforcement action against Nats Air Transportation Service (Docket 3456)

Mar 28—Hearing in air freight rate investigation (Docket 1705)

Mar 30—Prehearing conference on Seaboard & Western Airlines request for international all-cargo certificate (Docket 3641)

Apr 11—Hearing in reopened Hawaiian case (Docket 851 et al.)

Apr 11—Hearing on Board's investigation of through service and interchange requirements of St. Louis and Memphis. (Docket 3625)

May 2—Hearing on additional southern transcontinental service (Docket 1102 et al.)

May 16—Hearing on Hughes Tool Co. control of TWA. (Docket 2796)

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a **market prediction** of importance to operators requiring the Pratt & Whitney R-1830-92...

The prediction is for the prices of surplus zero time R-1830 model engines to continue their present upward trend <u>until they level off slightly below the cost of commercial overhaul.</u> Several factors are making this ascending market inevitable. The first is an increasing amount of expensive re-work caused by advancing corrosion in most eighteen-thirty surplus engines, the second is the increasing scarcity of surplus engines on the open market, and the third is the accumulation of very substantial blocks of the remaining engines by groups who are well aware of the present market tendency, and who, in many cases have been waiting for this time with the intention of "cashing in" on their holdings. The prices of most suppliers have already spiraled up from the seventeen-hundred dollar level to $2,000, and in some cases prices have gone as high as $2500. As these prices continue to climb they are releasing the competitive pressure which low-cost surplus engines have exerted to keep commercial overhaul prices low, and these in turn may climb. ***If this occurs the whole engine market*** will not stabilize until operators demonstrate what they can, and what they cannot pay for R-1830-92 engines.

If international tensions and the still present undercurrent fear of war perceptibly weaken it may be expected that a substantial number of zero-time engines will be released by the U. S. Armed Forces, in which case it may prove possible for this company to continue supplying its customers with converted R-1830-92 engines at its present price. ***But currently the fact is that the supply*** of 1830 model engines which can be economically converted and passed on to customers at reasonable prices is rapidly becoming undependable. Because of this, Steward-Davis is convinced that <u>the only way to guarantee the DC-3 and C-47 operators of the world a fine engine at a fair price</u> is to supply an engine not subject to the inflationary surplus market.

To do this, Steward-Davis is now completing the enlargement of its shops and the final planning of a production overhaul program based on its more than two years specialization on Pratt & Whitney R-1830-92 engines. These shops and this program will be geared to deliver a production model R-1830-92 Commercial overhaul at the lowest price consistent with the fact that safety and dependability are the pre-eminent criteria for any aircraft engine regardless of price.

The price of the Steward-Davis R-1830-92 production overhaul will be ***$2295 plus your run-out engine,*** and it will be warranted for 600 hours. Orders will be accepted for delivery beginning May 1st. <u>One year contracts</u> are available at discount rates to Operators wishing to plan future operations on this fine engine.

★This company is still producing the Steward-Davis R-1830-92 Conversion at **$1795** *exchange and will continue to supply this warranted conversion to its customers whenever possible, but only when, as now, it can safely offer its customers an R-1830-92 Conversion at a very substantial savings in comparison with the cost of newly major overhauled R-1830-92 engines.*

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STRICTLY PERSONAL

Louise Thaden writes from her home in Roanoke, Va., that she is a "Strictly Personal" fan. She contributes to today's column. Louise has been flying since 1927; she won the women's air derby from Santa Monica to Cleveland in 1929, the Bendix trophy race between New York and Los Angeles in 1936, and she set up a series of altitude, endurance and speed records. In 1938 she wrote a book, "High, Wide and Frightened." Her contribution follows:

I REMEMBER WHEN—

► Slim Lindbergh, then technical adviser to TWA, nearly drove the pilots crazy with his practical jokes. One was running up and down the aisle of the Ford, while in flight, with a heavy suitcase in each hand.

► We were working like mad around the clock trying to get Ernie Smith and Emory Bronte off on the first flight to Honolulu in one of the first Travel Air cabin jobs before Maitland and Hegenberger could get away in the Army's tri-motored Fokker. The Fokker, with the whole Air Corps behind it, won by a couple of hours. The Travel Air was so overloaded it took four of us on a side, pushing, to get it started rolling down to runway at Oakland Airport.

► The Department of Commerce stepped in and we had to quit using fence wire for emergency field repairs.

► Amelia Earhart drove from New York to Los Angeles to see what the country looked like from the ground.

► On the '29 Powder Puff Derby, Ruth Elder, flying a red airplane, lost her map in flight, landed in a pasture on which cattle were grazing, and prayed they were ALL cows.

► And Will Rogers wrote in his column "They have those poor female pilots landing at every buffalo wallow between Los Angeles and Cleveland with a Chamber of Commerce who'll put up a hot dog sandwich."

► We'd take in $900 every Sunday at San Francisco with one airplane hauling short hop passengers, two at a time, at $10 a throw.

► Pacific Air Transport (Seattle-San Diego) decided the mail must go through in bad weather too, but stopped the practice when the pilots consistently broke through in every attitude except right side up, and occasionally with zero altitude.

► We had never heard about carburetors icing up and the engines kept on running anyhow.

► You couldn't possibly fly without a leather jacket, riding breeches and helmet. Phoebe Omlie tried not doing it on the '29 Derby and had to borrow helmet and goggles so the guards would let her on the field and into her Monocoupe.

► It was possible to fly long X C's without benefit of compass, it being fancy extra equipment. (Standard equipment consisting of oil pressure and water temperature gauges and tachometer—usually war surplus.)

► There was never any difficulty getting a ride into town from the airport and, if you were itinerant, a ride back out again.

Yours for growing old gracefully. *Louise Thaden*

* * *

ALL ABOUT THE BOB SIX OIL DEAL—More than one airline president lifted a skeptical eyebrow when Continental Air Lines filed application to serve Casper, Thermopolis and Cheyenne, Wyo., recently. By sheer chance Continental's president, **Bob Six**, heads an oil syndicate nearby in that state's Skull Creek field. The syndicate hit pay dirt too, in liquid form. Some time ago when we were visiting Six at Denver he confided he had joined forces with CAL veteran pilot **Al Goodwin** in exploring the field. Others among the airlines refused to go into the deal with Six, so Bob wound up with Hollywood people like **Frank Sinatra**, **Johnny Meyers**, Director **Mervyn Leroy**. The wells blew in like a Texas sand storm, but with plenty of oil, too.

* * *

NONE FASTER, NONE FINER—Delta's Chicago office heard that the Jacksonville reservations crew was creating a fine public impression by answering the phone, "Good afternoon. Delta Air Lines, none faster, none finer, to and through the South." Chicago memorized a similar line and everybody had it down pat in no time until **Jane Wilson** broke up the office one day by answering the phone with "Miss Wilson, none faster, none finer . . ." R H W.

WHAT'S NEW

New Literature

"How to Select Flexible Waveguide Assemblies," a four-page book on three types of flexible waveguide constructions and their uses, applications and characteristics, available from Technicraft Laboratories, Inc., Thomaston Waterbury Road, Thomaston, Conn.

"Hydraulic Surface Grinders," an illustrated catalog of specifications and photos of machines for toolroom, production, plunge grinding and "hand grinding," available upon request to The DoALL Co., Des Plaines, Ill.

"Metal Quality," a 60-page booklet describing and illustrating the development of metal quality progressively throughout hot working conditions, available upon request to the Drop Forging Assn., 605 Hanna Bldg., Cleveland 15, Ohio.

"Cerro Alloys," data sheets on products of the Cerro de Pasco Copper Corp. Available with binder for the sheets from Cerro de Pasco Copper Corp., 40 Wall St., New York 5, N. Y.

"Agnew Resistance Heaters," a four-page catalog describing resistance heaters for annealing and other low temperature operations. Available upon request to the Agnew Electric Co., Milford, Mich.

"Catalog," describing high and low pressure equipment for all common gaseous fuels, including engineering data section on furnace design and heat input requirement calculations. Available upon request to Surface Combustion Corp., Toledo 1, Ohio.

"Welcome Aboard," a 44-page pamphlet designed to acquaint new passengers with service available in flight, inform them about procedures and terminology of air transportation. Available upon request to R. E. S. Deichler, vice president-sales, American Airlines, 100 E. 42 St., New York 17, N. Y.

"Aircraft Powerplant Handbook," latest Civil Aeronautics Administration technical manual available from Superintendent of Documents, Washington, D. C., price $1.25.

"Double Circle Tools," an 8-page circular illustrating miscellaneous tools, available from Chicago Latrobe, 411 West Ontario St., Chicago 10, Ill.

"Groundlight on New Zealand," fourth in a series of books for businessmen produced by British Overseas Airways Corp., presenting the country's potential as an export market. Available upon request to Publicity Assistant, BOAC, Airways Terminal, Buckingham Palace Road, London, S.W. 1. Price 2/6d per copy, or 2/9d by post.

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—MARCH 21, 1949

EDITORIAL

Kill the B-36 Rumors!

If you think the current fracas over the B-36 is a commotion, you are wrong. You have not seen anything yet. This fabulous super-bomber has been in the news five years or more. Now, almost overnight, it has been proclaimed the No. 1 airplane of the world's greatest air power.

If Air Force tests indicating the big ship's advantages under combat conditions are accurate, vitally important decisions are necessary, not only for the Air Force, but for the Navy, and for the entire National Military Establishment.

But before the Air Force can sell its case to the public there will be a severe storm, we fear, unless proper steps are taken to ward it off. The signals are unmistakable. In coming weeks the B-36 will undergo the most searching public examination ever given any single aircraft type. And rightly so. But we hope that both Consolidated Vultee and Secretary Symington are prepared for what may develop into a brutal knock-down-and-drag-out free-for-all in the press.

The stakes could hardly be greater—the national welfare. Like most aviation topics, the subject will be popular with the public and no details will remain unprinted. We only hope—if the fight is not staved off—that it will be clean. But we fear accuracy and fairness may be jettisoned in the heat of battle. If the controversy cannot be avoided, you can be sure of one thing, however—the American public in its own good sense will detect the truth and demand the right decision when all sides have had their say.

Before the Air Force is tempted to issue any questionable data about the B-36 to the public, under stress of a bitter conflict, it is to be hoped they will heed the importance of one fact, and seize the initiative toward dissipating one particular tiny cloud of doubt that is in the sky already, before it grows into a hurricane. Because the fact is that there is a small but talented group of aeronautical engineers who are convinced—rightly or wrongly—that the giant bomber cannot do what the Air Force has said it can do.

AVIATION WEEK has told you recently that the Air Force now plans an extensive development program on the B-36, including the application of turbojet and turboprop engines, swept wings, etc., that ultimately will place it in the 500 mph. speed category at 50,000 ft. We told you that with its four jet engines it will have a top speed of 435 mph. at 35,000 ft. These data were obtained from reliable sources and checked with the proper authorities, thereby making the information as authoritative as is possible for us to gather.

But there are experienced aeronautical engineers who say that the B-36 does not obtain the performance currently credited to it by its builders and the Air Force. And they add that in their opinion the B-36 can never attain the figures now anticipated by the development program. They tell us in its present configuration it does not exceed the following performance: top speed, 350-360 mph., ceiling 38,000 ft., range 8000 miles under combat conditions. The unanimity of these figures alone warrants their presentation, for they are the calculated performance of not one engineer, but a group of the most respected engineers in the field.

Something is wrong here. We have enough respect for the technical engineering talent of the industry to believe that they have arrived at their estimated performances figures honestly and on the basis of the best information available. On the other hand, we have learned to accept the "official" figures of the armed services.

Thus, an impasse suggests that either all of the tried and proved performance reduction formulas and methods are wrong or Convair and Air Force engineers have discovered some new design principle that puts the lie to the techniques used by other manufacturers.

If this latter is so, we believe all our engineers should have this information as a national asset so that their data can be brought up to date and the benefits of this new technique made available throughout the country—on a confidential basis, if need be.

But if, on the other hand, these engineers are correct, then obviously a great wrong is likely to be committed.

It is becoming clear that the Air Force intends ultimately to spend several billions of dollars on this project. If the performance anticipated by the Air Force is realized, then we commend them on a great technical triumph that confounded the best engineers of the day.

But if the B-36 does not complete the mission for which it is designed in time of war, assuredly a national peril could arise. No matter how many billions we invest in a weapon if it falls short of its mark at the critical time, that money has been wasted and we would have been far wiser to invest in something else, such as a bomber that would do a job perhaps less spectacular than that now claimed for the B-36.

AVIATION WEEK does not hereby declare itself anti-B-36 or anti-Convair or anti-Air Force. But it is pro-aviation to the hilt. We are convinced that there is a distrust of the B-36 among competent engineers in the business. We are furthermore convinced that this distrust cuts across individual company competitive emotions. We accuse no one. We support neither the engineers nor the Air Force on this subject at this point. But the fact that this distrust exists should be pointed out publicly, the sooner the better for all concerned. And it is impossible to keep such things below the surface. Rumors rise from such sources. Get the subject into the open. Meet the distrust and eliminate it.

What to do? Well, there are men and unemotional test equipment qualified to resolve the dispute. Before we spend another dollar, why not ascertain the exact and detailed performance of the B-36? Assemble a neutral group whose qualifications will satisfy all concerned. Put the big ship through a thorough-going flight test program. The results need not be made public but the Secretary of the Air Force and the Secretary of Defense should get the facts.

Once such results are compiled and all interested parties are appraised, there could be no foundation for rumor, no question of whether to forge full speed ahead on development or abandonment, no likelihood of Congressional investigations.

Certainly, such a program would be inexpensive, take only a few weeks, and resolve for all time the bitter debate that will undoubtedly build up from here on. Such a debate will be harmful to the armed services, to aviation, and to the country.

The Air Force should welcome such a test, for Secretary Symington has intimated a keen desire to kill a deadly whispering campaign against our No. 1 strategic weapon. We are in full accord with his desire in the matter. Let's kill the rumors now, let's kill the controversy before it really gets underway. If we don't kill it now, the battle may get out of control completely.

ROBERT H. WOOD

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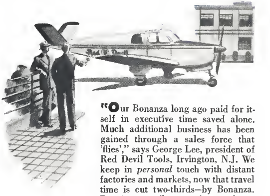

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